1925

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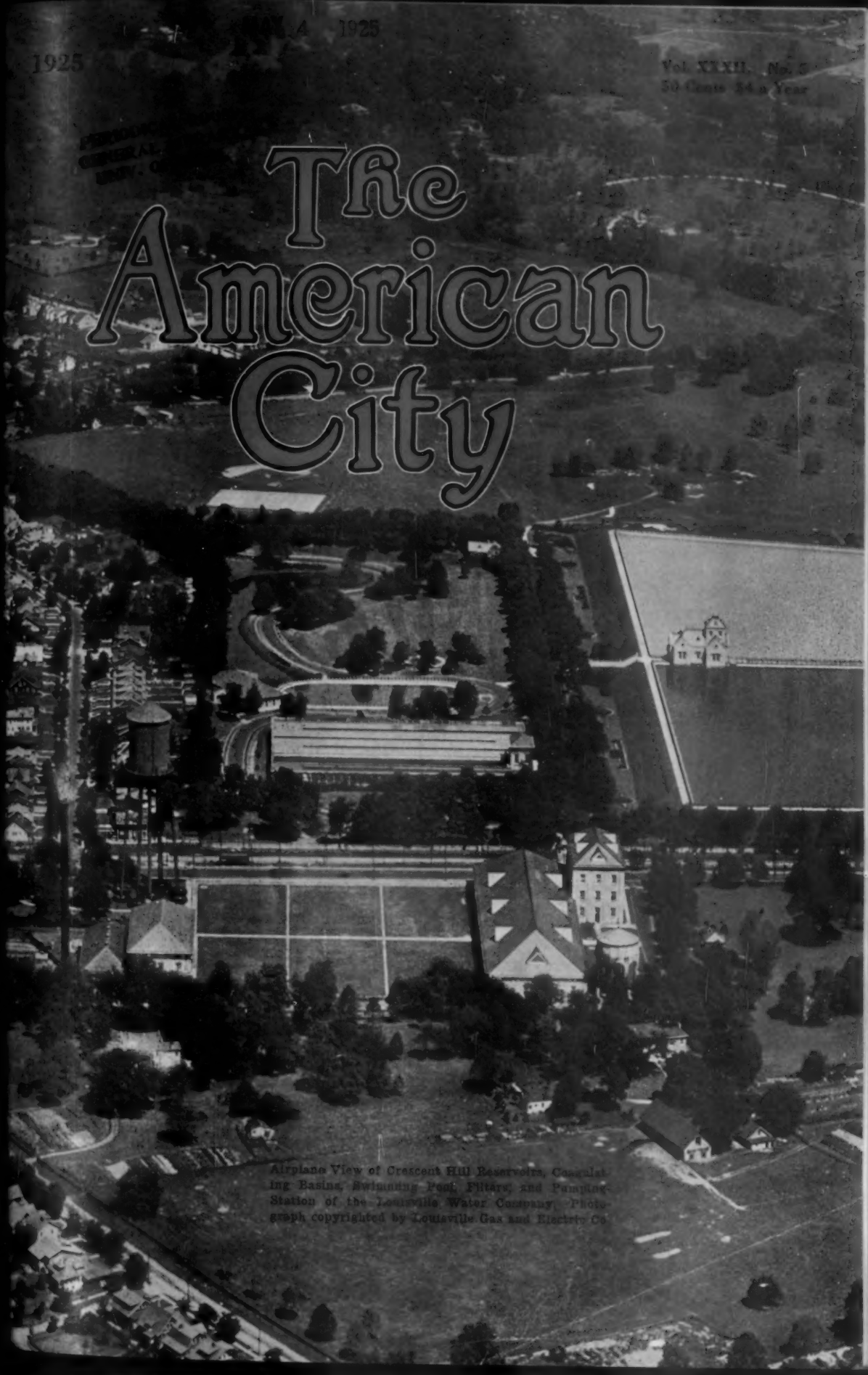
The American City



Airplane View of Crescent Hill Reservoirs, Coagulating Basins, Swimming Pool, Filters, and Pumping Station of the Louisville Water Company. Photograph copyrighted by Louisville Gas and Electric Co.

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New Jersey,

Is a "Taxless Town."

Power is generated by Fulton-Diesel engines in the South River plant at a total cost of approximately 1.8c per KW. Hour.

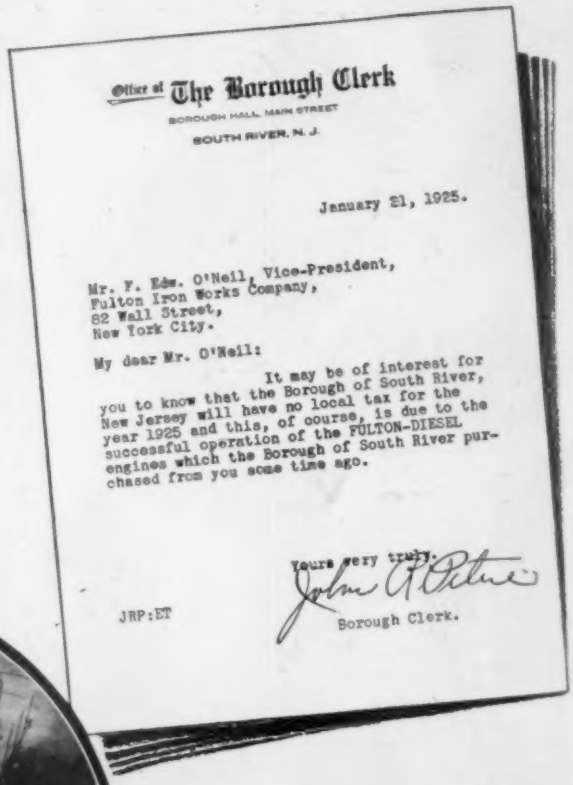
The Power Rate is 12c per KW.H. for the first 100 KW.H. down to 8c per KW.H. for 2000 KW.H. and over.

The difference (excepting line up-keep) is Profit.

This explains why South River is a "Taxless Town."

What has been accomplished in this city of 10,000 people, even at such reasonable rates, may be repeated in other communities by the installation of Fulton-Diesel engines.

Bulletin 807 discusses power plant installations in cities comparable to South River. We will gladly send you a copy if you'll ask for it.



Office of The Borough Clerk
BOROUGH HALL, MAIN STREET
SOUTH RIVER, N. J.

January 21, 1925.

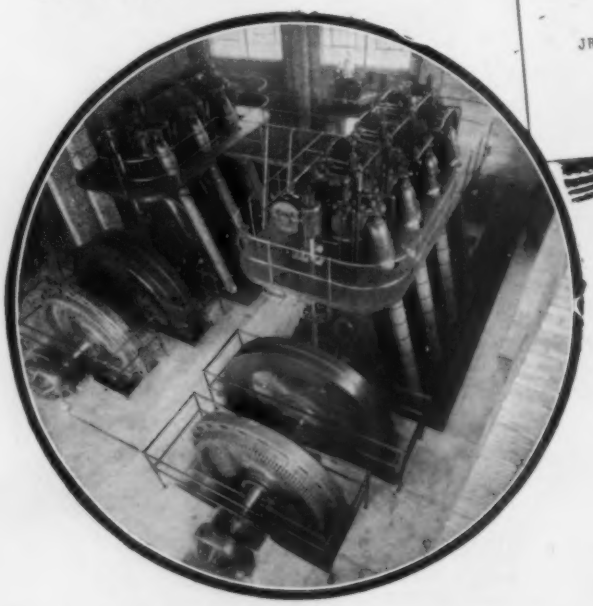
Mr. F. Edw. O'Neil, Vice-President,
Fulton Iron Works Company,
82 Wall Street,
New York City.

My dear Mr. O'Neil:

It may be of interest for you to know that the Borough of South River, New Jersey will have no local tax for the year 1925 and this, of course, is due to the successful operation of the FULTON-DIESEL engines which the Borough of South River purchased from you some time ago.

Yours very truly,
John A. Petrie
Borough Clerk.

JRP:ET



First engine started Sept. 28, 1922—520 B. H. P. Second engine started Sept. 18, 1923—700 B. H. P.

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No. 5

The American City Magazine

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The Proper Organization of a Water Department

Abstract of a Report by V. Bernard Siems, Water Engineer, Baltimore, Md.

THE success of any business enterprise depends on its conformity to the fundamental laws of political economy, which no authority of the business world will gainsay. In a broad sense, the city government assumes the role of the entrepreneur when it undertakes to market a commodity or service. In other words, it becomes a public corporation, which is defined as an organization performing public service in supplying the wants of society—the community being the consumer — maintained by public funds and operated without profit. The corporation whose form of business is of a quasi-public nature is known as a public utility. That department of the city government becomes a business unit which produces economic goods, that is, which furnishes a material good for consumption and a personal service; and, further, it becomes an entity when specialization of labor and function becomes necesary for the production of a single economic good or utility. Thus, for better efficiency there are created subsidiaries to a central unit, each of which, however, reserves individual identity, independent management and control, and, in fact, complete isolation except as to its subsidiary relation to the central unit through associated specialties.

Private corporations form subsidiaries because they recognize the gain in efficiency that is had from self-contained organization, and they organize such subsidiaries with complete functions.

The water department fulfills the requirements of this business entity. Its labor and function are specialized, its product a single economic utility which is the result of the manufacture of a material good from the raw product or free good, to which is added personal service, before it is finally consumed after having been delivered by the department to the consumer. It is then a public utility entirely individual, and should retain this individuality in the city government, in conformity to both legal and eco-

The Water-Works an Entity

The report from which this article is prepared was recently submitted to the Committee on Efficiency and Economy appointed by Hon. Howard W. Jackson, Mayor of Baltimore, for the purpose of studying the operation and control of municipal departments. This committee is composed of members of various local business enterprises who are giving their services gratis to the city in this work. Their aim is the complete centralization of the functions of the municipal departments, the establishment of a central accounting division, central storage division, central motor transportation division, etc. The attempt is made in this report to define the status of the Water Department of the city of Baltimore and to show the impracticability of the inclusion of a utility of this size and specialized functions in a Department of Public Works.

It is hoped through the study of this remarkably well-prepared report that large cities will appreciate the importance of having the water department report directly to the mayor (or city manager) and city council, rather than to a department of public works.

nomic law. The United States Supreme Court and other courts have held that when a municipality engages in the water business it conducts a "commercial enterprise" and is subject to the same rules at law as a private company engaged in the same business.

The Water Department as an Entity

What makes for this entity of the Water Department as an individual public utility? First, its function; second, its contact with the public, the taxpayer-consumers; third, its size; fourth, the requirements of its service; fifth, the unity of functions which is necessary to guarantee the fulfillment of its service requirements.

As to its function as a utility conducting a commercial enterprise, the water department is engaged solely in the manufacture, sale and delivery of one finished commodity, namely, pure water. Its revenue is derived entirely from the sale of this commodity and is not derived, as in the case of other departments that are not public utilities, from the general tax levy.

The water department is an entity as regards its contact with the consuming public, in that it has the power to fix rates and charges and to make regulations governing service as well as those regulations necessary to insure a plentiful supply of pure water. In the sale and delivery of its commodity the employees of the Baltimore Water Department come into direct contact with 165,000 purchasers and, in order to maintain an efficient service, it is essential that these consumers be in a position to make quick and satisfactory contact with the Department, which can only be had through its specialized employees.

As to the third element of the water department as an entity, its organization is large, both in personnel and in valuation, and in all respects is similar to a consolidated gas, electric light and power company, a utility corporation more nearly comparable to a water department in the nature of its service than any other public utility. The Water Department pay-roll of Baltimore includes at the maximum approximately 1,000 employees. A recent valuation of the plant under the control of the Water Board places it at approximately $40,000,000, and the capital invested is on the increase. The Department operates and maintains approximately 1,450 miles of water-mains and conduits, besides extensive impounding works, purification works and pumping-stations, all of which is specialized equipment used by no other department. The Department has under its direct control approximately 10,000 acres of land and exercises police control over approximately 310 square miles of land outside the city. The proper control of such a system requires a highly specialized organization with complete functions.

Regarding the service requirements of the Water Department as an entity, the Department is required under the Baltimore County Metropolitan Act to supply water to consumers outside the corporate limits and is subject to the jurisdiction of the Public Service Commission of Maryland, thus falling into the category of a private corporation. The nature of its utility makes it essential that the Water Department be in a position quickly to bring men and materials to places where its service is threatened by emergencies, such as breaks in water-mains and other interruptions incident to defects in machinery and equipment primarily necessary in pumping and purifying water. In other words, continuity of service is obligatory in this case; more so, perhaps, than in the case of any of the privately operated utilities of the city. It must provide constant fire protection for the entire area of the city. Further, in order to maintain friendly relations between the City Administration and the taxpayer-consumer, it is essential that the Department be in a position to discipline its employees, especially those who are in direct contact with the public because of the nature of their duties in handling house service connections and repairs. This discipline is weakened where there exists no "esprit de corps," a quality lacking in most existing boards of public works.

The inherent unity of the Department is self-evident when one considers that its employees are highly specialized professional workers, highly specialized artisans, and skilled and unskilled laborers, whose duties are confined to the requirements of constructing, operating and maintaining a satisfactory water-supply. There is no overlapping of functions between the Water Department and any other of the Baltimore city departments. This has been evidenced in the past by the poor showing of employees who have been transferred from other departments, an appreciable time being necessary to instruct these employees in the requirements of their new duties. The service which the Water Department as a public utility is obligated to render can be guaranteed only through complete control of all the factors of this service, intimate control of its machinery of production as well as its accounting and cost-keeping personnel. The taxpayer-consumer demands and will accept the services of Department employees only as regards questions

involving the use of water. In order to have efficient operation, it is necessary that we have through our own accounting personnel a close check, available at all stages of any project, upon the cost of individual operation and production units, as well as an accurate check on the receipts for the service rendered—such accounting and cost data as we now have always at hand, prepared by accountants with specialized knowledge and experience in waterworks.

It has been shown that legal and economic law requires that a public utility such as a water department be self-contained. To destroy this entity of the Water Department of Baltimore would therefore offend against laws of business economics. A prominent and familiar example of this well-established principle is found in the refusal of the Consolidated Gas, Electric Light and Power Company's officials to merge that utility with the United Railways and Electric Company of Baltimore. If the merger of two public service utilities is bad economically, it would appear even worse to merge a public service or quasi-public service with a distinctly public corporation. Centralization reaches the marginal limit of utility through the law of diminishing returns, and this applies very early in the case of city governments attempting to control public finances and public service functions and has led to the creation of subsidiary boards with broad powers, especially in the control of water-supplies. We have seen how any specialization of service leads to the formation of subsidiary corporations.

Learning, then, from the experience of the business world that a variety of separate specialized services cannot be supervised in detail by one central control, what would be the result of merging the business of supplying water with the other departmental functions of the city government? If a person would succeed in any profession or business, he must feel sympathetic toward the object of his effort. Any man at the head of many departments must necessarily feel more sympathetic toward one department or specialized group than toward others. The vitally important functions of the Water Department might readily be subordinated at the hands of a Director of Public Works who does not realize its needs at first hand. Nor can any unconnected bureau controlling any function associated with the service defined in the foregoing obligations of the Water Department operate with that degree of satisfaction to the consumer that would result from keeping this control in the hands of those directly responsible for the conduct or operation of the Department. The present efficiency of the Department is undoubtedly due to the singleness of purpose of its personnel; that is, supplying the demands of its consumers in an efficient and economic manner.

According to general knowledge of organization of municipalities along the lines of both the centralized mayor-council plan and the city manager plan, the department of water-supply is always found separate and distinct from the department of public works, even when a plan is adopted which is very similar to that proposed for Baltimore. If this fact is disregarded, it may be predicted with reasonable certainty that at some period or other attempts will be made to manipulate water-rates and regulations directly with the tax-rate. Any efforts which have been made in the past either to increase water-rates above the cost of production or to reduce them materially below the cost of production, have invariably been followed by a decrease in efficient operation. When the department is operated on a balance sheet, there is no incentive to purchase equipment or to employ personnel which will not directly reflect in reduced cost of operation.

Under present conditions the city of Balti-

Additional Favorable Comment

In commenting on the Water Board report of the organization of the Baltimore Water Department, Nicholas S. Hill, Jr., consulting engineer, New York City, said: "I think it would be a vital mistake and a step backward to consolidate the Water Department with any other department of the city government. This Department is, in fact, a public utility operated by the city and should be treated as any other public utility and made to stand on its own bottom. I should like to see all revenues of the Department applied to Water Department purposes and to make the Water Department responsible for making rates sufficient to make the Water Department self-sustaining; charging the city its fair share for fire service and other water used. I should also like to see the Water Department entrusted with the problem of financing new improvements and with regulating the Department as they would were it privately owned. This is the only way in which efficiency can be secured and the service rendered which the public has a right to demand."

more is obliged to perform certain functions in the counties. In performing these functions the Water Department has been able to conduct its work with dispatch because the head of the Water Department has had the power to confer directly with the county authorities and also to make regulations without the delay necessarily incident to the submission of these matters to a Director or a Board of Public Works. If the identity of the Water Department were lost, and the cost of service, for the reasons shown, thereby increased in the counties by a lowering in efficiency, it is quite probable that the Public Service Commission would compel the city to absorb these excess charges out of its tax-rate and to supply the County Commissioners at a reasonable cost; that is, at a cost comparable to that now properly chargeable for such work or service.

In the event of the subordination of the Water Department to a Board or Department of Public Works, it may be further predicted that the present promptness of service rendered by the Department to complaining taxpayer-consumers and county consumers would be greatly hampered by the lack of control over its necessary transportation facilities. Machinery and vehicle equipment are now kept at a high state of efficiency through prompt repairs and through the absence of routine which would operate against prompt attention. By virtue of the present material yards and shops, the Department is enabled, further, to repair quickly any defective mains and pumps and even employ the same force to manufacture, at a fraction of the market price, certain of its specialties, such as manhole vaults, etc. Moreover, a review of the amount of material moved and the traffic management of Department motor equipment confirms the efficiency of the present plan of complete control over the up-keep and movement of this equipment.

Broader Powers Necessary

In fact, rather than curtail the present powers of the Department, it seems essential to efficiency and economy that these powers be broadened. The various organizations of the city enjoy corporation functions only in so far as these functions are granted by express legislation of the state. The Water Department is now a state agency not expressly incorporate, being a quasi-corporation, endowed by legislative enactment with certain powers which can best or only be exercised corporately. "To such bodies is given the name of quasi-corporations, and as to them the rule is that, for the purposes defined in the creating statute, their status is that of true public corporations; they are such by implication."—France; "Principles of Corporation Law."

It seems advisable then to request from the State Legislature such powers as will enable the Water Department to operate more nearly as a true public corporation. The personnel of the Water Board, composed of seven members, including the Mayor ex-officio, the Comptroller ex-officio, and the Water Engineer, should be direct representatives of the taxpayers of the city, the common and preferred stockholders in the municipal corporation, one of the non-ex-officio members to be appointed each year for a term of five years. The Board should have control over bond issues designed expressly for the improvement of the water-supply, should fix and control rates, collect revenue, and perform such other duties and make such regulations as are directly essential to the operation of the Department. The rates would be fixed at such a level that they would not alone provide for the operation and maintenance of the system, but also supply the interest and sinking fund payments necessary on bond issues, a method of financing which is provided for in the creation of the Baltimore County Metropolitan District. These rates would be a direct index to the efficient operation of the Department and would give the voter of the city an opportunity to criticize its operation and to express his approval or disapproval of its management at the polls.

If the Water Department were merged with the Board or Department of Public Works, dissatisfaction with its operation would almost certainly lead directly to the creation of a city commission on public utilities which would have direct jurisdiction over all public utilities operating in the city of Baltimore, and would likely lead further to public ownership of all privately owned, as well as public, utilities, crystallizing the public sentiment which now exists for such an ownership. The recently drafted charter for Kansas City, Mo., provides for the public ownership and operation of all public utilities.

In support of the foregoing recommendations for increased powers, attention is called to reports from other cities:

Hartford, Conn.—Caleb M. Saville, an authority on the financial management of water-works, in the *Journal* of the American Water Works Association, January, 1924, page 64, says, "We are practically a private corporation. We have a charter of our own, although it is a municipal corporation. The only connection we have with the city is that each year the Mayor appoints two members to the Board, who are confirmed by the Council. After that, the

Board functions independently, using all its funds as it deems proper, and can sue and be sued. If we change the rates, they have to be approved by the Council, as does also the bond issue, which becomes then a city obligation.

Detroit, Mich.—The Water Department of this city supplies 1,371,500 people. After the radical reorganization, centralizing the governmental functions of the city, the following powers remain with the Water Department: (a) the Department is governed by a Board of Water Commissioners appointed by the Mayor; (b) the Board awards contracts on advertised proposals; (c) the Board conducts all employment activities under Civil Service Commission regulations; (d) the Board plans for additional supply; (e) the Board has power to establish rates; (f) the Board has power to supply water outside city limits; (g) the Department is self-sustaining and is obligated to pay principal and interest on bond issues; (h) bond issues must be approved by the Mayor and City Council; (i) the Board operates storage yards, shops, and construction machinery; (j) the Board has direct control over its own collection, cost and general accounting, auditing, and complaint divisions.

Los Angeles, Calif.—In the 1925 revision of the city government the Water and Power Board is composed of five members and approved by the Council. This Board has full jurisdiction, even to the extent of making an independent budget, and is answerable only to the Mayor and the City Council. The Board of Public Works controls construction and maintenance of streets and sewers, street cleaning, garbage and sewage disposal, and public buildings, but not the Board of Water Supply.

Summary

Nothing more need be said. Bureaus of water-supply have been included in departments of public works, and, on the other hand, they have been isolated and given the broad powers of complete control. In the latter cases the operation has been successful, and examples of such successful operation have been cited in the foregoing paragraphs.

A municipality engaged in the water business is by action of the courts considered as a private company. The Water Department of Baltimore is such a business unit. By all the rules of business law, it should retain this entity and should even be given, according to the practice of private enterprises, every power making for an independent control, without which is lost the stability of management dependent upon a proper coordination of responsibility. The business of the Water Department cannot be successfully conducted except in accordance with economic law and sound business practice.

Keep Utility Up to Standard, Says Mayor of Providence

"JUST as I believe it is my duty to call public attention to the fact that I disagree with a public service corporation when I do disagree with it, so I think it is equally my duty to praise it when it is doing good work," said Mayor Joseph H. Gainer of Providence at a recent convention of the New England Association of Gas Engineers.

"I have not always praised the gas company," said Mayor Gainer. "There have been times when I have taken violent sides against the policies of the company. I know you public utility men sometimes think of us in public life as just natural enemies. You think we don't want to see you exist and prosper, but I think most of us do.

"We are elected to represent the public, and there are two ways you men in public service companies can accomplish your mission. You must get results for your stockholders—that is natural—but there are two ways of getting those results. You can go along in the old-fashioned way, just getting your dividends, or you can go along producing your commodity in the best and most up-to-date fashion, reducing costs so that your dividend can go on and at the same time the public can get the advantage of all the new advances in science. And that is all any man in public life, who is honest, tries to do.

"So when we disagree, I want you to feel that most of us, anyway, are not trying to injure the utility. We are trying to keep the utility up to the standard at which we believe it ought to be kept in the interests of the public, as well as in the interests of the stockholders."

Important Convention Planned for International Association of Municipal Electricians

PAPERS and discussions on some of the most important municipal problems of the day, including traffic control, fire-alarm telegraph, police telegraph, and street lighting, will be leading features of the annual convention of the International Association of Municipal Electricians, to be held in the Hotel Statler, Detroit, August 17-20, 1925. The program was developed at a recent meeting of the Association's arrangements committee, consisting of Jacob Grimm, President; William Potts, Chief Electrical Engineer, Police Department, Detroit, Mich.; Louis Gascoigne, Superintendent of Fire Alarm, Detroit, Mich.; J. T. Greene, Superintendent of Fire Alarm, Toledo, Ohio; K. W. Mackall, Crouse-Hinds Company, Syracuse, N. Y.; A. MacLachlan, Square D, Detroit, Mich.; and Daniel J. Morgan, Sales Engineer, Hazard Manufacturing Company, Wilkes-Barre. Jacob Grimm, President of the International Association of Municipal Electricians, is Chief of the Police Signal System of Buffalo, and the Secretary is William Arbuckle, Superintendent of Fire Alarm, Bayonne, N. J.

Decreasing the Discomfort of Traffic Officers

AT the best, the job of directing the flow of vehicular and pedestrian traffic at a busy corner is neither the safest nor most comfortable occupation in the world. Some of its risks and hardships are inherent in the task itself; but some of them could be greatly lessened by a little forethought on the part of city officials and police chiefs.

Is there any good reason why traffic officers and policemen generally should be compelled to swelter in midsummer in uniforms designed for cool-weather comfort? Is the wearing of a coat every day in the year essential to dignity or efficiency? Some cities have learned that the answer is "No," and are providing the members of their police and traffic squads in summer with uniforms which both feel and look much more comfortable than the "fireless cooker" type of outfit.

THIS TRAFFIC CORNER-MAN IN NORFOLK, VA., WEARS A GRAY WOOLEN SHIRT AND A CORK HELMET IN SUMMER

Bridgeport, Conn., is a case in point. In the spring and fall months the traffic officers' uniform, as reported by Chief of Police P. J. Flanagan, consists of a regulation blue police cap, a blouse or dress coat, regulation blue trousers, and black puttees. In winter a police overcoat is added. In summer the coats are replaced by a white shirt with a soft, white attached collar and a black bow tie; with the addition of a rain-goods blouse for inclement weather.

The winter and summer styles of uniform in Cincinnati are shown in the accompanying pictures. Chief of Police William Copelan believes not only in protecting his traffic officers from the heat of the sun, but in protecting traffic violators from unnecessary heat on the part of the patrolmen. On this subject he writes to THE AMERICAN CITY:

"It must be taken into consideration, as we inform our patrolmen, that petty violation of the traffic laws is not occasion to cause excitement or irritation on the part of members of the force, because it is undoubtedly a fact that ninety-nine per cent of such violations are unintentional or the result of thoughtlessness on the part of the presumed violator; hence, a little courteous warning will go a long way toward preventing a recurrence of same, and at the same time establish that entente cordiale between the driver and police so necessary for the successful handling of traffic."

From S. W. Ironmonger, Chief of Police of Norfolk, Va., comes the following interesting letter:

"Beginning the summer of 1920, with the comfort of traffic officers in view, blouses were discarded and gray flannel shirts adopted, worn with black four-in-hand ties. In addition to the shirt, tropical cork helmets, manufactured by the Lehman Cork Helmet Company, were purchased.

"We experimented several years ago with umbrellas and booths for traffic officers, but it was our experience that with their use the most efficient directing of traffic did not obtain; so that at this time no shelter is provided from the sun, with the exception of the tropical cork helmets.

COLD-WEATHER AND HOT-WEATHER UNIFORMS FOR TRAFFIC OFFICERS IN CINCINNATI

"Small lattice-work wooden platforms are permitted, to keep the feet of the traffic officers from direct contact with the scorching pavement during the high temperatures, and also to prevent their standing in water during rain-storms. Heavy arctics are also issued to corner-men for use during cold and wet weather.

"While we have considered uniforming traffic officers in white raincoats for use during rain-storms or fogs, we have not selected a model up to this time. The tropical helmets, however, polished white, have a high degree of visibility, and the corner-men are now using white gloves all the year round, which also greatly improves the visibility of their signals.

"To reduce hazards to the traffic officers at night, overhead spotlights have been installed directly over the intersection of streets, which throw a beam of light approximately 8 feet in diameter directly on the officers. This causes them to stand out clearly and makes it possible for their signals to be readily understood.

"The flannel shirt has been so popular with the corner-men that, beginning last year, all patrolmen were permitted to wear them without blouses as part of their uniform, but with the use of puttees to prevent a slovenly appearance.

"For our motor-cycle officers, Sam Brown belts have recently been adopted for appearance and also in order that the officer, while riding, will have no difficulty in reaching his revolver for use."

The use of umbrellas attached to traffic semaphores has been found feasible in many cities as a protection to the corner-men from the summer sun. For winter protection traffic booths can be used in certain locations. Both of these methods are employed in Auburn, N. Y., whose Chief of Police, William C. Bell, reports that traffic booths, equipped with electric heaters and well ventilated, are in use in the winter months. These booths have a red light at the top during the night, which answers as a "silent cop" when the officer is off duty. During the summer the traffic booths are removed and umbrella semaphores are installed, the traffic men wearing white shirt waists during the hot season.

MOTOR-CYCLE OFFICERS IN NORFOLK, VA., WEAR SAM BROWN BELTS

Some cities are making life more safe for their traffic officers by providing them with a white cap and belt to enable drivers of vehicles to see them more readily at night or in heavy fogs. In addition to adopting this type of uniform, Chief of Police T. D. McCarthy, of Utica, N. Y., reports that a spot light is thrown on the traffic officers. No traffic booths are provided, but the corner-men are relieved more often in extreme weather. J. Allan Wood, Chief of Police of Kingston, N. Y., writes that his city provides umbrellas as a protection from the sun, and this season will begin the use of a summer uniform without a coat. The comfort of

TRAFFIC CONTROL BOOTH AND SIGNALS IN CLIFTON, N. J.

the men is also being promoted by shorter hours and frequent relief.

A type of officer's traffic control booth used in Clifton, N. J., is shown in the accompanying illustration. This is equipped with a special traffic control panel for operating the signals shown, which are of the Horni type. The booth is 38 inches square, and is 7 feet 8 inches in height to the eaves from the floor level. On three sides are riveted balanced metal sash with double thick window glass, which can be opened and remain in position where placed. The walls and roof of the booth are lined with ¼-inch Johns-Manville Transite. Provision is made for space for an electric heater. Specifications for the booth and the traffic control panel can be obtained from the Horni Signal Manufacturing Corporation of Newark, N. J.

In Elmira, N. Y., Chief of Police E. D. Weaver reports that traffic towers are in use, equipped with electric heaters for cold weather and electric fans for warm weather. These towers and a somewhat similar type recently installed in Syracuse, N. Y., were built by the Crouse-Hinds Company, of Syracuse. In the Syracuse tower the manual and automatic control switches for thirty-two street intersections are housed. The hexagonal tower, 40 inches on a side, is fabricated of structural steel, the supporting shaft being a 12-inch "H" beam supported by a substantial concrete foundation. The floor of the tower is 14 feet above the sidewalk, and the height to the eaves is 21 feet 6 inches. There are five windows, each with only the upper sash movable and a glazed door. This gives the officer unimpeded vision in all directions. An electric light, a telephone and an electric heating unit are provided for his comfort.

Chicago and Milwaukee Defeat Traction Ordinances

BY decisive majorities the voters of Chicago and Milwaukee, at referendum elections on April 7, rejected proposals which had been made for the solution of the complicated traction problems of their respective cities.

The Chicago plan contemplated ultimate municipal ownership and operation of the entire local transportation system, and control meanwhile by a Municipal Railway Board. Of the nine members of this board, three would have been chosen by the Mayor with the approval of the City Council, three by a committee representing the purchasers of the Municipal Railway Certificates, and three by agreement between the Mayor and this committee. Funds for the purchase of the existing surface and elevated lines, and for the construction of subways and rapid transit extensions, would have been provided, not by the issuance of bonds, but by Municipal Railway Certificates payable as to interest and principal solely out of the earnings of the property.

It is estimated that if the ordinance had been adopted, certificates aggregating from $600,000,000 to $700,000,000 would have been issued over a 20-year period, the proposed outlays including about $163,000,000 for the purchase of the present surface lines and $85,000,000 for the elevated system. The rates of fare charged were to have been enough, but not more than enough, to pay the cost of efficiently maintaining and operating the transit system, to pay the interest on the Municipal Railway Certificates, and meet sinking fund requirements.

The Chicago plan had the endorsement of some of the most prominent and conservative bankers of Chicago, and of most of the civic organizations and newspapers. It was opposed by the Hearst papers and by the *Chicago Daily Journal*, and was bitterly denounced by the Chicago Federation of Labor as "the most gigantic and brazen steal of the people's rights and the people's money that was ever written into a piece of legislation anywhere in the country." Chicago had the rather unusual experience, therefore, of a municipal ownership project advocated by the more conservative elements and opposed by the more radical elements of the community.

The Milwaukee Proposal

The plan rejected by the Milwaukee voters on April 7 was a "service-at-cost and municipal acquisition contract," applying to the traction lines of the Milwaukee Electric Railway and Light Company in that city and adjacent suburban communities. Under the proposed contract the valuation of the properties was tentatively fixed at about $56,000,000. Cost of service was defined as all operating expenses including taxes and rentals, reasonable allowances for depreciation and operating reserves, and a stipulated return to the company. This was to have been, for the first year, 7.7 per cent upon the valuation as finally agreed upon. In lieu of the present right of the city to acquire the properties by condemnation, the contract would have given the municipality an option to purchase the properties within the contract area, as an entirety, upon six months' notice, at a price equal to the agreed value of the investment in the properties with certain adjustments for reserves, etc. Fear that the adoption of the project would result in an immediate increase in fares was an important element in the overwhelming defeat of the measure.

For a discussion of Bases of Rate Making by C. W. Koiner, City Manager, Pasadena, Calif., see page 202, The Municipal Index for 1925.

The Resurfacing of Badly Worn City Pavements

By R. H. Simpson

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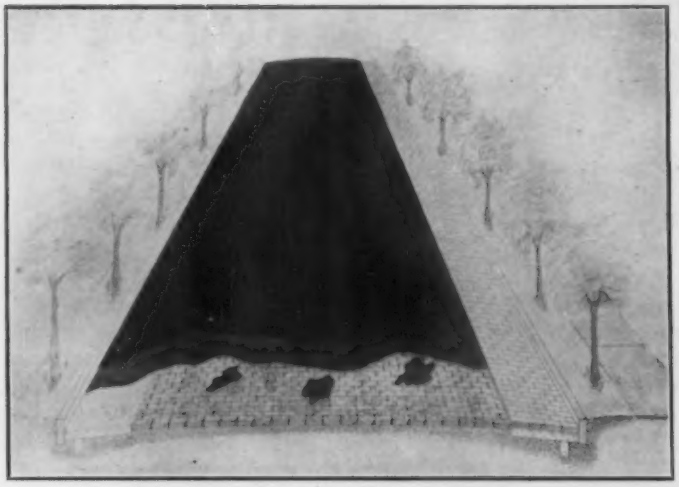
THE resurfacing of badly worn city pavements is a subject that is receiving considerable attention at the present time. The large increase in motor traffic has brought about a demand for smooth roadways, and many cities are attempting to transform their old pavements into boulevards by the use of some type of bituminous surface. Most of our highway engineers have also recognized the economy of salvaging whatever value there is in their old roads, and are resurfacing gravel and macadam roads with asphalt or other bituminous material. The increase in the construction of this type of pavement is no doubt due to the fact that the financing of a paving program, in most communities, is becoming a serious problem, and any saving that can be made in construction cost that does not lower the value of the service rendered by a pavement, is certainly justified. In some cities this work is being done by the application of a layer of asphalt having a thickness of only ½ or ¾ of an inch, and frequently this is feathered out to zero at the curb and at the rail of a street railway track. Such construction is no doubt justified as a temporary measure, but in this discussion I will ask you to keep in mind that resurfacing means the laying of a high type of asphalt surface on an old pavement, the latter being considered as a foundation for the new surface.

Through the cooperative efforts of all agencies engaged in the work, the science of road building has made greater strides during the past quarter-century than for many centuries past. The industry is growing at a tremendous rate. We are now spending a billion dollars a year on roads and pavements. Engineers have been so busy planning and supervising the construction of this vast volume of work, that I wonder whether we have taken enough time to investigate the work done in the past, with the idea of utilizing in our present-day practice the experience gained from past performance.

BRYDEN ROAD, COLUMBUS, SHOWING ASPHALT LAID OVER OLD BOULDER PAVEMENT IN 1888

City pavements have been subjected not only to traffic but to the heat and rain of many summers and the snow and ice of many winters, and it is the action of traffic combined with these destructive agencies that, more often than traffic alone, shows up the defects in pavements or causes failures in them. It is a remarkable fact that while many of our old city pavements were designed for traffic conditions as they existed twenty-five or thirty years ago, some of them are in good condition to-day and are carrying a traffic never dreamed of at the time they were built. From the experience gained during the past half-century, municipal engineers have generally recognized the three fundamental requirements of a properly constructed high-class pavement to



SECTIONAL VIEW ILLUSTRATING TYPICAL CONSTRUCTION WITH TWO METHODS OF GUTTER CONSTRUCTION

be: (1) a stable, well-drained subbase; (2) a firm foundation, strong enough to carry the loads to which it will be subjected; (3) a smooth wearing surface to withstand the abrasion of traffic and protect the base and subbase from the action of the elements.

It is pretty well recognized that the subbase and foundation of a street or road should be constructed in such a way as to be a permanent investment, but that the wearing surface must of necessity be repaired from time to time, and may ultimately have to be entirely renewed. In the resurfacing which I will describe to you these fundamentals were kept in mind, as such work in Columbus has been attempted only when the condition of the old pavement fulfilled the foregoing requirements for base and subbase.

Methods Used in Resurfacing Old Pavements in Columbus

There are four types of old pavements that have been resurfaced in Columbus, namely, brick, boulders, stone block, and macadam. Of 195,110 square yards of this type of construction, about 72 per cent of the work has been on brick, about 20 per cent on boulders, and 8 per cent on macadam and stone block. In general, it may be said that the results from stone block and brick have been uniformly successful and that in the case of the boulder pavements the results have been generally successful. The resurfacing over macadam has been of such recent date, the oldest pavement having been laid in 1922, that no general conclusion as to the merits of this work can as yet be stated.

The oldest paved roadway in the city of Columbus is Bryden Road, from Parsons Avenue to Twenty-second Street. It is a street with a 40-foot roadway, and carries a large volume of traffic, from 8,000 to 10,000 vehicles daily. It is a sheet asphalt pavement laid in 1888 over boulders, and is therefore 36 years old. We have no record as to when the original boulder pavement was laid, but it consisted of a foundation of about 6 inches of crushed stone, the boulders being imbedded in sand on top of this base. At the time the asphalt resurface was placed on this roadway it was thought necessary to coat the boulders with a bituminous material so that the asphalt would adhere better to the surface; therefore, cold tar pitch was sprinkled over the boulders before laying the asphalt. The asphalt was then laid without any binder, in the same manner as sheet asphalt is laid at the present time, being dumped on the roadway and shoveled to place and raked to the proper thickness and then rolled. Two or three years later several other streets were laid in a similar manner, and, with one or two exceptions, the pavements are smooth and are giving excellent service to-day. In 1912 another old pavement of this type was resurfaced, but in this case a binder course was used and the pavement laid in the same manner as a sheet asphalt paving. One of the streets resurfaced over boulders in 1891 is on our program for reconstruction this year. The subbase conditions on this street are not first class, and the construction of a sewer, some years ago, added to subbase defects. Another pavement laid the same year has shown rather high maintenance, due, partially, to frost action. The pavement on Bryden Road, however, is in very good condition to-day.

Resurfacing Brick Pavements

The resurfacing over old brick pavements has been done in more recent years, and we have definite information as to the details of the work and the construction method. Practically all these old brick pavements were originally constructed between the years 1888 and 1892. They were laid on a macadam base, which consisted of crushed limestone averaging about 8 inches in thickness, and water-

bound with crushed stone screenings. After rolling, a 2-inch cushion of sand was spread over this surface, on which was laid the brick, and the joints were filled, in almost all cases, with cold tar pitch. These old pavements have given good service, although there had been considerable repair work on most of them, and all had had, for some years preceding resurfacing, a rough surface which did not meet the requirements of motor traffic.

All of the resurfacing over brick has been done only after a careful investigation of the subgrade conditions, as evidenced by the condition of the paving and the curbing. In some cases where there was a question about the condition of the foundation or the subbase, actual excavation was made to determine these conditions definitely. If it was found that the curbing had become displaced by frost action, or that the brick in the surface had, in places, become displaced, we should naturally conclude that there was an unsatisfactory subbase condition or a weakness in the foundation, or both, which, if extended over a considerable area of the improvement, would make resurfacing impracticable. The best time to discover a weakness in a pavement is in the spring when the frost is coming out of the ground, and it has been our practice, for some years past, to observe our old pavements at this season, so that we may know of any weakness in subsurface conditions which would make resurfacing unjustifiable. We have, in Columbus, some brick pavements laid on macadam bases, in which ground water comes to the surface in the spring, and it is not unusual to see sections of these pavements utterly destroyed by traffic at such time, the brick being actually thrown out of position or asphalt disintegrated and broken up by the traffic. Clearly, it would be a waste of money to attempt resurfacing under such conditions.

It may be said that any pavement that has retained its general shape and contour for a period of ten or twelve years shows evidence of a satisfactory subbase and foundation and that such a pavement may be resurfaced with a reasonable expectation of securing satisfactory results.

In preparing plans for the resurfacing of any pavement it has been our practice to take cross-sections at frequent intervals, which are platted on cross-section paper to any convenient scale. From these sections a new crown for the proposed surface is worked out which gives the required minimum thickness desired for the new surface, or 1½-inch binder, 1½-inch top. On account of the worn condition of the old pavement, these sections will usually disclose the fact that at certain points the old surface must be built up to form a satisfactory crown, and where this condition is such as to require a thickness of 3 or 4 inches of binder, it has been our practice to place it in two operations; that is, the low sections of the street are first brought up, with binder, to a crown 3 inches below that desired for the finished work, and then the surface is put on in the usual manner.

If the depth of the gutter in the old pavement cannot be reduced safely, it has been our practice to take up a strip of the paving 4 or five feet in width, and either to lay a concrete foundation at a lower grade, over which the asphalt surface may be laid, or to lay a brick gutter that will give the proper depth of the curbing and a shoulder 3 inches deep against which to lay the asphalt. In this connection I might say that in sections of the city where there is considerable parking of automobiles, it is our practice, both in resurfacing and in the construction of new asphalt

FIFTH STREET, COLUMBUS, SHOWING BRICK RELAID TO FORM SHOULDER FOR ASPHALT

pavements, to lay a 6-foot strip of brick or granite block paving next to the curb, as a parking strip for automobiles.

An extremely important feature in connection with resurfacing is the laying of drain tile along the curb on each side, and at other points if necessary, in order to insure a properly drained subbase. We have used drain tile on all of our street construction in the last twenty-five years, and in resurfacing, where tile was not used originally, we lay 4-inch farm tiles 24 inches below the surface of the paving, just in front of the curb line, with outlets at catch-basins or sewer manholes.

In many cases we have found it desirable to reset and recut the curbing in connection with resurfacing, practically all of the curbing used in Columbus being Ohio sandstone. This is not absolutely necessary unless it has been forced out of position by frost action, but it improves the appearance of the improvement, and the cost is only a small percentage of the total.

Our contracts for this kind of work are all let on a unit price basis, that is, a square-yard price for the surface, which includes 1½-inch binder and 1½-inch top, and a cubic-yard price for additional binder. The first step in the construction of such an improvement is to excavate for the strip along the curb, lay the drain tile, reset the curb, if necessary, and lay the foundation strip along the curb, including the brick surface, if brick is used. The old pavement is then thoroughly cleaned with the use of water from a fire-hose, and men follow along behind with push brooms, sweeping the surface thoroughly to insure the removal of all dirt and foreign substances from the surface of the brick and the joints. After the pavement is thoroughly cleaned and dry, it is then ready for an application of the extra binder to bring the surface to the proper crown. When this is done, the regular binder course and the top course are laid in the same manner as the laying of a regular sheet asphalt surface.

At intersecting streets it is necessary to relay a portion of the pavement on such street in order to meet the grade of the new work. If this be an asphalt pavement, a portion of the old surface can be heated and removed and new top added, building it up to meet the new crown. If it is a brick or block pavement, it is best to relay a number of rows of the brick or block at the proper grade to form a shoulder for the asphalt.

The resurfacing over stone block is done in about the same manner as over brick, the proper crown being mapped out and the surface laid as described above.

Resurfacing Macadam

The first macadam pavement resurfacing was done in 1922 and the second in 1923, these two being the only pavements of this type resurfaced in Columbus. Both of these pavements had been built for twenty years, or more, with brick gutters along the curb, and the old curbing, brick gutters and macadam had shown evidence of satisfactory subgrade conditions. The macadam had a thickness of 14 inches. This surface was scarified to a depth of 3 inches and the material removed, after which the surface was rolled to a grade that would permit of the laying of 3 inches of asphalt and meet the shoulder of the brick gutter.

As stated before, it is too early to form an opinion as to the results of this work, as my experience shows that it takes from ten to twelve years of service to demonstrate whether or not a particular type of pavement is a success, and I will give you, later, some evidence in support of this conclusion.

The problem of resurfacing a street containing car tracks is one that is rather difficult of solution, unless the tracks are reconstructed. We have attempted this on one street only, a main thoroughfare on which the maintenance cost had been very heavy for several years, and on which it was the desire to improve the surface without the expense of reconstruction. This work was done by city forces out of funds appropriated from maintenance, and if the new surface will last seven years, the cost of the work will not be in excess of seven years' ordinary maintenance.

In this case a strip of brick about 12 inches wide along the outer rails of the car tracks was relaid at such a grade as to give a shoulder against which to lay the asphalt, and at the curb the thickness of the resurfacing material was reduced to 1½ inches in order to give a proper depth of gutter. Asphaltic concrete was used on this work except for a distance of about 2,000 feet on one side of the street, where Kentucky rock asphalt was used in order to try out this material for this character of work. As an experiment, there was also laid for a short distance a manufactured asphaltic material known as cold-laid asphaltic concrete.

This material was all laid without a binder course, and to a depth of 2 inches, except at the rail and curb, where it was reduced to 1 inch. The work was done during the fall of 1924, and while it has promise of giving satisfactory results, it will take some years to

demonstrate whether this cheaper type of construction is justified.

Cost of Resurfacing

The cost of resurfacing will vary in different communities, depending on the cost of labor and material. In Columbus, when done by contract, the work costs, where binder is used, from $1.65 to $1.75 per square yard, and where the curb is not reset, or new gutter laid, it has been done for from 50 to 60 per cent of what new construction costs, depending on the amount of additional binder required to provide a proper crown for the street. When new gutters are laid and the curbing reset, the cost amounts to from 65 to 75 per cent of the cost of new work, depending on the type of paving that is specified for the gutters.

SCENE ON FIFTH STREET, SHOWING RESET MANHOLE TOP AND CONDITION OF BRICK SURFACE AFTER CLEANING AND LAYING BINDER COURSE

Maintenance

The maintenance cost of city pavements is a subject that has not been given as careful investigation in the past as is warranted by its importance. However, it is now being recognized that the maintenance of city pavements is a very important part of city service, and it is receiving more consideration in the financial program of progressive cities. In Columbus we have been able, especially in later years, to secure funds enough to maintain our pavements in a fairly satisfactory manner. The pavements on which maintenance costs are given herein are in good condition to-day.

In preparing some maintenance data on our resurfaced work in connection with this discussion, a comparison of such costs with the maintenance cost of the ordinary type of sheet asphalt construction is of interest. Prior to 1907 our asphalt repairs were done by contract on a unit price basis, the area of the surfaces repaired being carefully kept and payments made in accordance therewith. In 1907 the city installed an asphalt plant of 1,000-yard capacity, and since that time the repair work has been done by city forces. We have continued, however, to keep the same data as when the work was done by contract, namely, the repaired area and the cost. To arrive at the cost, we figure the entire cost of the season's work, including labor, material, supplies, a charge for use of plant, etc., and divide this by the total yardage of the repaired area, which gives the same unit cost to be applied to each street, regardless of location or distance from plant.

During the last three years I have been compiling these figures for all of our pavements, some 6,000,000 square yards, and 1,300 improvements, with the idea of having a complete service record of each particular improvement, and we have just completed this work for our asphalt pavements, involving some 300 improvements and 1,770,000 square yards. In compiling these figures it has been my aim to show each year for each improvement: (1) the area of the improvement; (2) the area repaired; (3) the cost of the repair; (4) the cost per yard of total area; (5) the average cost per yard per year.

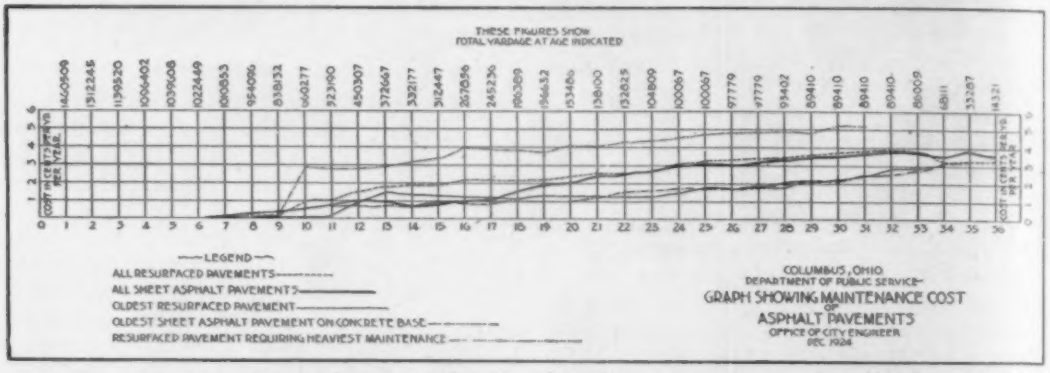
This last figure is really the service test of a pavement. It gives the average yearly cost over any period of years. As a pavement becomes older, it will cost more per year to maintain it and, unless we know the age, the maintenance cost does not mean much. The average cost per yard per year is obtained by dividing the total cost of repairs up to a given date by the total area of the improvement in yards and dividing this quotient by the age of the improvement. Thus, a 20-year-old improvement having an area of 10,000 square yards, on which the total maintenance cost during the entire 20-year period was $5,000, would have an average maintenance cost per yard per year of 2½ cents. The maintenance on the resurfaced work over the old

boulder pavements, the oldest of which was paved in 1888, averages a little over 3 cents per yard per year for the 36-year period. The resurfacing over the brick pavements, including 24 improvements, has been done since 1912, the aggregate yardage of this work being 149,889 yards. The average age of these pavements is 5.6 years, the oldest being 12 years. The total maintenance of these 24 improvements, since they were constructed, amounts to $719, or .00086 cents per yard per year. In other words, if the combined yardage of these pavements was considered as a highway 18 feet in width, this highway would be 14.2 miles in length and would have cost about $8 per mile per year for maintenance.

The accompanying chart gives, graphically, the maintenance figures for asphalt pavements, the age being shown by the horizontal ordinate and the cost in cents per yard per year by the vertical. The heavy dash line shows the aggregate of all resurfaced pavements at the various ages. These figures have been obtained by adding together the maintenance cost for each improvement at a certain age, regardless, of course, as to when the improvement was made, the points for the curve being obtained by dividing the total cost up to a given year by the total yardage of pavements that were in service on that year, and then dividing this quotient by the number of years. The heavy dotted line shows the expenditure for all sheet asphalt pavements. The solid fine line shows our oldest resurfaced pavement, which, as you will note, has a remarkable record. In order to make a comparison, I have given a broken line showing the oldest sheet asphalt pavement on a concrete base. The resurfaced pavement which has required the most maintenance is shown as a broken line above all other curves, and I have shown this in order to give an idea of the range in maintenance cost as well as the average. From this chart a line could easily be platted from which the maintenance cost for asphalt pavements could be estimated at any age. You will note that these curves all take a decided rise somewhere between the tenth and the twelfth year, indicating a comparatively heavy maintenance cost at this time. Most of them flatten out after that period, and in case of some of them the cost during the next few succeeding years is less than at that period. This fact seemed rather startling to me, and in order to determine, if possible, the reason for heavy maintenance at this age period, I made some studies of several pavements of various types.

Our earlier asphalt pavements were constructed under a ten-year guarantee, and the records seemed to show that a few of them had been neglected for two years or more prior to the expiration of this guarantee, which would naturally increase the cost at that time; but for the last 15 years our guarantee period has been 5 years, so that the heavy maintenance on all of the pavements cannot be attributed to neglect immediately prior to the expiration of the guarantee; in fact, we have a large yardage that has passed the tenth year without requiring any maintenance. On the other hand, I have found that we have a number of pavements carrying heavy traffic on which the records seem to confirm the theory that the period of heavy maintenance is when they are from ten to twelve years of age. To illustrate, an important street leading to the north was paved with asphalt in 1911. The present traffic on this street is about 12,000 vehicles daily. It passed the 5-year guarantee period without requiring maintenance. At the age of 8, the cost per yard per year was .008; at 10 years, .045; at 12 years, .07.

We have another main thoroughfare leading to the north in Columbus that was constructed in 1908. This was a brick pavement on a concrete base with a tar filler. It receives very heavy traffic, a count indicating that a traffic of approximately 16,000 vehicles uses this roadway per day. During the years 1921, 1922 and 1923 this pavement was entirely resur-


THESE FIGURES SHOW TOTAL YARDAGE AT AGE INDICATED
LEGEND
ALL RESURFACED PAVEMENTS
ALL SHEET ASPHALT PAVEMENTS
OLDEST RESURFACED PAVEMENT
OLDEST SHEET ASPHALT PAVEMENT ON CONCRETE BASE
RESURFACED PAVEMENT REQUIRING HEAVIEST MAINTENANCE
COLUMBUS, OHIO
DEPARTMENT OF PUBLIC SERVICE
GRAPH SHOWING MAINTENANCE COST OF ASPHALT PAVEMENTS
OFFICE OF CITY ENGINEER
DEC. 1924

faced, because the brick were so badly worn and broken as to make the street unfit for modern traffic conditions.

Another street 50 feet in width, carrying approximately the same amount of traffic, was constructed in 1911 of brick with a grout filler. This street was in excellent condition for a ten-year period, but during the last three years we have been obliged to give it considerable maintenance, and the maintenance cost up to date has averaged about 4½ cents per yard per year.

Probably the most striking example is afforded by a sheet asphalt pavement laid on a portion of a thoroughfare leading to the east, a street which carries about 12,000 vehicles daily at the present time. This was constructed in 1890. In 1901 this roadway was resurfaced, and in 1913 it was resurfaced for the second time. In 1924 we were obliged to reconstruct this pavement because during the spring of 1924 ground water came to the surface and destroyed such large areas that it was not considered wise to attempt any repairs. This failure was due to an improperly drained subbase and a weak foundation, but the point to which I wish to call your attention is the fact that in spite of this bad condition this pavement gave satisfactory service for from eleven to twelve years after each repair.

In addition to these examples as bearing on this heavy-maintenance period, I wish to call your attention to an article by Professor French of McGill University, published about two years ago, giving the results of an inspection of about 340 miles of concrete roads in northern United States and Canada. His conclusions were that on heavy-traffic roads these concrete pavements were in such condition as to need resurfacing at the age of nine years, and the light-traffic roads at the age of thirteen years.

Based on our records, there seems to be ample evidence that when a pavement has required heavy maintenance it has been during the tenth to the twelfth year after construction, but I do not wish to be understood that such conditions are common to all pavements.

For instance, of the total yardage of our asphalt streets that are ten years old, or more, 60 per cent of their area, or 396,293 square yards, has reached that age without requiring any maintenance. Forty per cent has reached the age of twelve years without maintenance, 16 per cent, 15 years, and we have four streets with a total area of 11,443 square yards which have been in service eighteen years without maintenance expense. However, as a result of these studies and supported somewhat by Professor French's investigation, it would appear that there is a critical period in the life of all pavements, and that this period is from the 10th to the 12th year after construction. Pavements may pass this period successfully by reason of favorable traffic and other conditions, and they may develop a weakness before this time by reason of abnormal conditions, but the evidence seems to show that serious defects in subbase, foundation, or wearing surface do not necessarily develop until this critical period, and we should hesitate, therefore, to draw any definite conclusion as to the merits of a pavement until such pavement, after twelve years' service, with moderate maintenance, is found to be in satisfactory condition.

While the diagram indicates that from the tenth to the twentieth year after construction the maintenance on resurfaced work has been greater than for asphalt pavements on a concrete base, beyond the twentieth year the maintenance is substantially the same, and we can therefore conclude that the results from the resurfaced work, as measured by maintenance cost, are nearly, if not entirely, equal to the results obtained from other construction. In fact, a comparison shows that the resurfacing over old brick pavements which were completed twelve years ago is now in as satisfactory a condition as, and has received no greater maintenance than, other work constructed at the same time.

These results are due largely to the care used in selecting for resurfacing only those streets which, after long service, have shown evidence of satisfactory subbase conditions, and only by a study of these conditions, and correcting them if unfavorable, can a successful pavement of any type be constructed.

In conclusion, let me suggest that the pioneer day of constructing modern pavements is past, and in the future the problem will be studied in the light of experience gained from past performance. For I believe that from a study of the behavior of our pavements under actual traffic and climatic conditions, more can be gained to aid us in solving our paving problem than in any other way.

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Treating a Hard, Muddy, Polluted River Water

Operation Results at the Water Purification Plant at Topeka, Kans.

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THE water purification plant at Topeka, Kans., which consists of aerators, grit chambers, mixing chamber, settling basin, prefilters, coagulating basin, final filters, and sterilizing apparatus, has been in operation for approximately two years. It is the aim of this article to describe the results obtained from the treatment of the hard, muddy, and polluted Kansas River water. Equipment is provided for feeding alum, lime, soda ash, and chlorine so that the plant can be operated either for the clarification of the turbid river water alone or for clarification combined with softening. The normal capacity of the plant as regards preliminary treatment, that is, aeration, settling, mixing and coagulation, is 8,000,000 gallons per day, and filter equipment is provided for a normal rate of 6,000,000 gallons per day.

EXTERIOR OF THE TOPEKA, KANS., FILTRATION PLANT

Raw Water

The character of the water of the Kansas River is extremely variable, and this stream, as regards water-supply, may be classed as hard, turbid, and polluted. In the following table the average monthly turbidity, alkalinity, total hardness, bacterial count, and B. coli index are given, and these figures represent conditions familiar to most of the purification plant operators of the Middle West.

Day-to-day and even hour-to-hour variations in turbidity and other characteristics are frequent, and often wide and constant vigilance in adjusting chemical feeds to existing conditions is a prime requisite for successful operation.

Water Consumption

During 1923 a total of 1,425,250,000 gallons of water, or an average of approximately 4,040,000 gallons per day, was treated at this plant, at which approximately 97.8 per cent, or 3,951,000 gallons, was pumped to the city. The table at the top of the next page shows the monthly average rates, together with the maximum each month:

In 1920 the city of Topeka used an average of 3,600,000 gallons per day, with a maximum of 4,700,000 gallons, and the increased

CHARACTER OF RAW WATER, BY MONTHS

Month	Average Turbidity (Parts per Million)	Average Alkalinity (Parts per Million)	Average Total Hardness (Parts per Million)	Bacterial Count	B. Coli Index
January	218	258	250	2.815	15.85
February	119	264	295	2.106	2.33
March	369	228	261	3.957	12.25
April	1.411	208	242	5.242	27.10
May	3.445	153	202	18.420	37.70
June	3.940	125	139	15.760	152.50
July	3.290	128	134	16.500	*
August	1.358	158	174	11.960	50.00
September	1.195	195	237	1.900	203.00
October	1.579	165	192	9.000	85.00
November	199	236	270	5.120	2.70
December	154	254	298	1.910	3.80

*B. Coli tests not made this month.

AVERAGE AND MAXIMUM MONTHLY RATES OF FILTRATION

Month	Total Filtered Million Gallons	Wash Water Million Gallons	% Wash Water	Average Day Million Gallons	Maximum Day Million Gallons
January	122.38	2.110	1.73	3.93	5.63
February	111.56	1.91	1.72	3.99	4.74
March	118.43	2.05	1.73	3.83	4.53
April	111.12	1.93	1.73	3.71	4.45
May	117.80	1.60	1.36	3.78	4.98
June	123.12	2.34	1.90	4.10	5.50
July	131.01	2.27	1.73	4.22	6.05
August	135.67	4.49	3.65	4.37	5.35
September	126.62	2.98	2.35	4.21	5.13
October	127.69	3.61	2.83	4.13	5.52
November	129.55	3.75	2.90	4.30	5.55
December	120.30	3.03	2.51	3.87	4.55
Total	1,475.25	32.52			
Average			2.20	4.40	

present consumption, approximately 12 per cent, represents in part the normal growth of the city, but is also due to the fact that the present water-supply is entirely adequate and more popular than the old ground water-supply, which contained considerable iron and was quite hard.

Low-Service Pumpage Operation

Water is pumped from the river or from the old system of wells, if desired, into the aerator by means of motor-driven centrifugal pumps through a discharge line which is fitted with a float-controlled valve to maintain the water-level in the basin at the proper elevation.

Aerator

The aerator is of the multiple-pan type with a total weir length of 900 feet and a drop of 15 inches. With river water, the principal service of the aerator is the elimination of odors from decayed organic matter, which are at times quite evident in the raw water. The aerator is also in service in the removal of carbon dioxide from the raw water preparatory to softening, but, because of the unusual high turbidity of the water and the resulting difficulty in making dissolved oxygen or carbon dioxide tests, no attempt has been made to determine its actual efficiency

Grit Chamber

The grit chamber, which was designed for a detention period of one hour at an 8,000,000-gallon rate, during 1923 actually had an average period of from 111 to 126 minutes, and as a result more sedimentation took place here than was intended. A large amount of relatively large-size grit and sand is pumped up with the raw water, and this makes the sediment from the basin hard to handle.

The floor of the basin is filled with underdrains, which terminate in 1¼-inch openings in the floor, spaced 5 feet on centers both ways, and which lead to header pipes fitted with quick-opening valves.

The system has not proved an unqualified success, on account of the relatively large amount of grit, and it has been found necessary to empty this basin several times and flush out the heavy sediment with a fire-stream; but it has saved a considerable amount of time and water, since with this system the period between flushings is materially longer

OPERATING FLOOR OF THE TOPEKA FILTRATION PLANT

than would be the case if flushing alone were relied upon.

Mixing Chamber

The mixing chamber has a capacity of approximately 180,000 gallons and is intended to provide a period of 30 minutes at the nominal rate of 8,000,000 gallons per day, but under actual conditions during the last year this period has been from 60 to 71 minutes. Thorough mixing is obtained by the operation of motor-driven agitators or paddles and by the flow of the water itself through the baffled basin.

This system of mixing, while entirely adequate, has two defects: first, the normal wear and tear on gears, bearings, and other mechanical parts; and, second, the tendency of dissolved lime to accumulate in the corners formed where the baffles join the walls of the basin, an accumulation which tends to clog the underdrains. Care and attention are required for the mechanical parts, and the second defect has been overcome by placing water jets in the corners where the accumulation occurs, to keep the sediment in motion.

THE SETTLING BASIN OF THE TOPEKA PLANT

Chemical Feeding Equipment

Alum is fed in the form of solution through orifice-boxes so located that it may be applied at the entrance of the mixing chamber, the entrance to the settling basins, and the entrance to the coagulating basin. Lump alum is used, and the solutions are made up in two wood-stave solution tanks located on the second floor of the plant.

Hydrated lime is fed through two dry-feed machines fitted with steel hoppers which permit feeding this dusty chemical from a separate room on the second floor. The application of lime is made at the entrance to the mixing basin only. Soda ash, when used, is fed through a dry-feed machine direct to the mixing basin. Motor-driven agitators are provided in the hoppers of the lime and soda-ash machines to prevent caking of the material.

Settling Basins

From the mixing chamber the water flows by gravity into the settling basins, two in number, with a combined capacity of 1,950,000 gallons, or 6 hours' flow for the nominal capacity of 8,000,000, and from 10.6 to 12.5 hours' flow for the draft during 1923.

The basins are operated in parallel and are filled with skimming weirs at each end and A-frame baffles in the center. The water depth is 16 feet, and the average velocity in the basin during 1923 was from 0.15 to 0.18 feet per minute.

The settling basins are filled with underdrains similar to those in the grit basin, and because of the more finely divided condition of the sediment their operation is much better. There is a tendency for them to clog, however, at the inlet end of the basin and at the extreme ends of the laterals, and it has been necessary to flush the basins out with fire-streams at intervals of approximately six months.

Roughing Filters

The roughing filters are three in number and are similar in construction to the final filters, with the exception that the filtering material is an 18-inch layer of ¼-inch screened Joplin chats, laid on a graded ground bed.

These filters are operated at a rate of 4 gallons per minute per acre, or approximately double the rate of the final filters; and while little or no clarification of the water is effected, the real purpose of the filters, that is, the removal of excess carbonate hardness, is fulfilled, as shown by the fact that during 1923 the carbonate alkalinity of the water applied to the filters, as shown by the monthly average result, did not exceed 13 parts per million.

Coagulating Basin

The coagulating basin, which receives the water from the roughing filters and delivers it to the final basin, is similar in construction and size to the grit basin, except that it is baffled.

The time of coagulation is from 110 to 130 minutes under present conditions, and will be reduced to 60 minutes when the capacity of the plant is reached. The present velocity within the basin is approximately 3.3 feet per minute.

Final Filters

The final filters are six in number, each with a nominal capacity of 1,000,000 gallons per day. They are hydraulically operated throughout and of standard construction, except for the underdrains, in which perforated pipes have been substituted for the standard strainer system.

Excellent results have been obtained with these filters since they were put into operation. In 1923 the wash water used amounted to 2.2 per cent of the total. The average turbidity of the settled water for the same period was 73 parts per million.

Sterilizing Equipment

The original sterilizing equipment consists of a duplicate installation of W & T manometer type liquid chlorine machines, but in the fall of 1923 the city installed two electrolytic cells of the Williams type and these were operated during November and December and have been operated intermittently since that time.

Sufficient data are not at hand to determine the actual cost of sterilizing with the electrolytic cells, as they have not yet been used long enough for a thorough trial and as the cost of the electric current which is produced at the pumping plant has not been determined accurately.

There seems to be no difference in the results from the two systems, however, as far as sterilization of the water is concerned, which is as would be expected, since a pound of chlorine gas will naturally do the same work regardless of its origin.

Operation

The water purification plant is under the supervision of a chemist, and the operation force consists of three men, each of whom has an 8-hour shift. Extra help for maintaining the grounds, buildings and equipment, cleaning basins, or other work not connected directly with the operation of the plant, is furnished as needed by the water department.

Plant Control

The laboratory tests for the control of the plant are as follows:

1. *Turbidity.*—Run on raw and settled water daily or oftener if the condition of the water seems to be changing.
2. *Alkalinity.*—Run on raw, settled, and filtered water daily.
3. *Carbonate alkalinity.*—Run daily or oftener on settled and filtered water.
4. *Total hardness*—Run daily on raw water and filtered water by soda reagent method.
5. *Free chlorine.*—Run on sterilized water daily or oftener. (Ortho-tollidin method.)
6. *Bacterial count.*—Run daily on raw, settled, filtered and sterilized water. (Nutrient agar plates incubated 24 hours at 37 degrees Centigrade.)
7. *B. Coli.*—Run daily on raw, settled, filtered, and sterilized water. (Presumptive tests in lactose broth, read at 24 and 48 hours' incubation at 37 degrees Centigrade.)
8. *Mineral analyses.*—Run on raw and filtered water each month on a composite sample made up of portions of each day's run.

The proper amount of the various chemicals to be fed is determined each day by the chemist, and his instructions are placed on a blackboard in the operating room.

Daily records are kept in the operation of the filters, the chemical feeding rates and analytical results, and the quantity of water treated, and these records are summarized each month for the permanent plant record.

Results

When the plant was put into operation, it was decided to produce a treated water with not to exceed 135 parts per million of hardness, but on trial it was found that the sudden change from the hard well water was not popular and resulted in so many protests from the water users that the softening was partially eliminated, with the intention of increasing it gradually so that the effect would not be so noticeable.

The old supply, as is usual with hard iron waters, had a noticeable taste, and the change from this to softened water with little or no taste caused many complaints of "flat taste" or "druggy taste," etc. During 1923, however, the total hardness of the treated water was gradually reduced from 167 to 127 parts per million, and no complaints have been made.

The following table gives the hardness of the raw and treated water by months during 1923:

	Total Hardness of Raw Water Parts per Million	Total Hardness of Treated Water Parts per Million	Reduction Parts per Million
January	250	167	83
February	295	166	129
March	261	153	108
April	242	137	105
May	202	138	64
June	139	111	28
July	134	107	27
August	174	135	39
September	237	131	106
October	192	133	59
November	270	139	131
December	298	127	171

RECORDS OF TURBIDITY AND OF BACTERIAL TESTS

	Turbidity Parts per Million		Bacteria per Cubic Centimeter		B. Coli Index	
	Settled Water	Filtered Water	Filtered Water	Sterilized Water	Filtered Water	Sterilized Water
January	72	None	86	71	1.485	.0000
February	18	"	37	18	.04	.0020
March	36	"	35	24	.362	.0000
April	50	"	71	41	.45	.0192
May	140	"	84	47	2.80	.0000
June	145	"	89	44	1.53	.0033
July	58	"	74	46	.....	.....
August	67	"	108	44	1.36	.0000
September	112	"	126	85	.48	.0000
October	60	"	101	47	.87	.0064
November	59	"	78	28	.07	.0000
December	52	"	37	17	.09	.0000

AMOUNT OF THE VARIOUS CHEMICALS USED DURING 1923

	Lbs. Alum Used During Month	Lbs. Lime Grains per Gallon	Lbs. Lime Used During Month	Lbs. Soda Ash Grains per Gallon	Lbs. Soda Ash Used During Month	Grains per Gallon	Lbs. Chlorine Used During Month	Lbs. per One Million Gallons
January	13,540	.77	105,750	6.04	.....	....	368.7	3.05
February	14,000	.88	114,900	7.22	.....	....	350.	3.06
March	22,050	1.30	91,450	5.40	13,400	.94	348.5	2.94
April	39,550	2.45	80,150	5.05	14,300	.92	373.	3.36
May	75,500	4.52	76,900	4.57	17,800	1.07	475.5	4.42
June	100,100	5.70	78,550	4.46	10,500	.61	491.2	3.98
July	68,800	3.68	57,650	3.06	9,800	.53	547.2	4.38
August	28,550	1.50	63,850	3.36	8,100	.43	568.5	4.27
September	22,600	1.25	85,600	4.72	13,700	.78	443.5	3.52
October	41,500	2.27	65,350	2.58	4,650	.56	535.5	4.21
November	11,700	.63	102,950	5.57	11,890	.65*	276.	3.41
December	11,700	.68	136,850	7.80	18,250	1.09	.....	....
Total	449,590		1,059,950		122,390		4,804.6	
Average		2.14		5 13		.75		

*19 days only.

COST OF TREATMENT EXCLUSIVE OF OVERHEAD CHARGES, MAINTENANCE AND POWER FOR 1923

Month	Cost of Lime	Cost of Soda Ash	Cost of Alum	Labor and Supervision	Chlorine Cost	Treatment Cost	Million Gallons Treated	Cost per Million Gallons
January	560.47	.....	234.24	600.00	47.93	1,442.64	122.4	11.78
February	608.87	.....	242.20	600.00	45.50	1,496.57	111.6	13.46
March	484.68	234.50	387.46	600.00	45.40	1,746.04	118.4	14.74
April	424.80	250.25	684.22	600.00	48.50	2,007.77	111.1	18.06
May	407.52	311.50	1,301.15	600.00	62.00	2,682.17	117.8	22.76
June	416.32	183.75	1,731.73	600.00	63.80	2,995.60	123.1	24.33
July	305.54	171.50	1,190.24	600.00	74.60	2,341.88	131.0	17.87
August	338.40	141.75	483.91	600.00	73.90	1,637.96	133.7	12.25
September	453.68	239.75	390.98	600.00	57.60	1,742.01	126.6	13.75
October	346.36	81.38	717.95	600.00	69.70	1,815.39	127.7	14.21
November	545.64	208.08	204.75	600.00	.....	1,558.47	129.5	12.03
December	725.30	319.37	204.75	600.00	.....	1,849.42	1,120.3	15.37
Average								15.82
Total	5,618.00	2,147.00	7,780.00	1,800.00		23,315.92	1,473.20	

ACKNOWLEDGMENT.—From a paper read before the Iowa Section of the American Water Works Association.

Small Indiana Town Has New White Way System

MADISON, IND., a community of about 6,500 population, has arranged for a modern white way lighting system in the business district. This installation will include 52 ornamental Novalux lighting units, equipped with 600-candle-power incandescent lamps with alabaster globes with rippled alabaster canopies. The units will be mounted on Union Metal Company poles, 12½ feet above the curb, the poles being arranged opposite each other at intervals of 90 feet. G-E constant current transformers and parkway cable will also be used. The cost is being met by the business men.

MOHANSIC PARK, WHERE WESTCHESTER COUNTY HAS LAID OUT TWO PUBLIC GOLF COURSES
One 18-hole course will be opened early in the summer of 1925

County Park Development and Regional Planning

By Jay Downer
Chief Engineer, Westchester County Park Commission, Bronxville, N. Y.

THE Westchester County Park System has two fundamental aspects:

1. It is a large-scale planning project, the objects of which are to promote healthful living conditions, provide recreational areas, and develop motor parkways to make such areas and the various parts of the county conveniently accessible to each other.

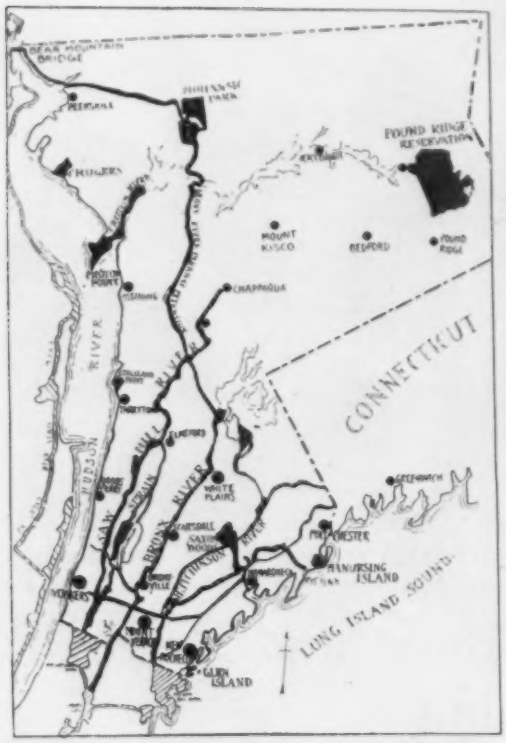
2. It will stand the test usually applied to any business enprise, in that it will make adequate, even liberal, return on the capital invested.

In recent years great interest has developed in city planning. This interest has logically been extended to regional planning, particularly in metropolitan areas. Such planning has a sound economic basis, and the need for it is evident to any one who has given the matter consideration.

Westchester County is made up of a collection of cities and villages rapidly encroaching on the open country and filling up the intervening spaces. A continuation of this process at an accelerated rate is assured and the encroachment on the open country will continue whether it is planned for or not. By properly planning for this inevitable growth, we may secure healthful living conditions, recreational areas, and facilities for traffic, the value of which in comfort, convenience, and enjoyment cannot be computed. Furthermore, the failure to properly plan for future growths results in increased costs of living and doing business, amounting in the aggregate to large sums. The sound economic or dollars-and-cents value of proper planning is thus established.

$10,411,000 Voted for Expansion of Westchester County Park System

The accompanying article by Chief Engineer Downer has especial timeliness because of the approval given on April 6, 1925, by the County Board of Supervisors, to expenditures aggregating $10,411,000 for further expansion of Westchester County's park and parkway program. The new appropriation makes possible the adding of 6,000 acres of new park reservations, about 45 miles of new parkways and boulevards, four new golf courses, modern bathing pavilions, and scores of ball fields, tennis courts, and play fields.



WESTCHESTER COUNTY, N. Y., SHOWING PRESENT DEVELOPMENT AND NEW PROJECTS APPROVED BY BOARD OF SUPERVISORS APRIL 6, 1925

Park Systems Must Consider Motor Traffic Conditions

A park system can be much more economically and satisfactorily established in advance of the growth that inevitably forces other public improvements. Access to the various units of the system depends upon connecting traffic arteries which we call parkways. The enormous practical values of these parkways are at once apparent, for, in addition to making the parks accessible, they provide routes for the rapid and convenient movement of passenger traffic between various parts of the county. By segregating this class of traffic on the parkways, great relief will also be afforded existing highways on which the movement of business and truck traffic will be greatly facilitated.

The general plan of the park system must be largely visualized in terms of motor traffic conditions, not only as at present but with large future increases. Parks laid out on the ideas of fifty and even twenty years ago, with a winding, possibly intricate, system of driveways adapted to leisurely carriage riding, cannot cope with present traffic conditions.

Horse-drawn vehicles made journeys in relatively short stages. The volume of highway traffic was very much smaller and a road system connecting the centers of population in a more or less disjointed manner served all purposes. But now tremendous mobility of traffic, both for pleasure and business, demands through routes from end to end of the county and intersecting lines from the Hudson River across to the Sound.

Seen in its broadest aspect, then, our park plan consists of two basic elements: first, park areas or reservations of vacant land favorably situated for, and adapted to, recreational purposes; second, a system or network of intersecting parkways or boulevards connecting the various park reservations and making them accessible from all parts of the county.

Units Already Acquired

A number of principal elements or units of a comprehensive park system have already been acquired. The county's natural advantages of location afford splendid opportunities for waterfront parks and bathing-beaches. Parks have therefore been acquired at Croton Point, Kingsland Point, and Crugers on the Hudson River, and at Glen Island and Manursing Island on the Long Island Sound shore. Interior parks have been acquired in the Tibbetts Brook Valley at Yonkers, at Woodlands in the Saw Mill River Valley near Ardsley, and at Silver Lake in White Plains. Mohansic Park, the great reservation of 1,100 acres at Yorktown, was conveyed by the state to Westchester County for $1.

The Bronx River Parkway from Bronx Park to Kensico Dam, now nearly finished, and paid for jointly by the city of New York and Westchester County, is too well known to require description. It has afforded a very effective demonstration of the value of parkways.

Substantial progress is being made on the Saw Mill River Parkway from Van Cortlandt Park to Chappaqua, the Hutchinson River Parkway from Pelham Bay Park to the Connecticut line, and the State Parkway, which is an extension of the Bronx River Parkway from Kensico Dam to the Bear Mountain Bridge. These parkways in general follow stream valleys and make the most effective possible use of lowland which is unfit for habitation and generally characterized by dumps and nuisance conditions. They constitute some of the main elements of a framework or arterial system, the need for which is deeply felt.

A Factor in Developing Retail Trade

Yonkers, Mount Vernon, New Rochelle, and White Plains, the four cities of the county, are rapidly developing as retail distributing cen-

given the matter consideration.

is thus established.

FORMER SWAMP IN BRONX RIVER VALLEY AT WAKEFIELD, NEW YORK CITY

BRONX RIVER PARKWAY DRIVE, ACROSS THE FORMER SWAMP AT WAKEFIELD

ters. Transit and traffic congestion in New York City makes shopping there an increasingly difficult task especially for women. Retail trade in the county will develop in proportion to the accessibility and convenience for shopping of Westchester County's population centers.

The parkways are a very important factor in providing such accessibility. Passenger traffic for pleasure or business will flow to the parkway routes as fast as they are built. Excessive mixed traffic on existing highways now causes delays in the transportation of workmen, business and professional men, resulting in the waste of valuable time. Expensive motor trucks, making two or three deliveries or trips in a day where they should make five or six, burden materials and merchandise with excessive charges.

The points here briefly outlined serve to suggest some of the underlying fundamentals of our plans for the park system and its far-reaching importance to the county. The liveliest imagination cannot visualize Westchester's future development. It has progressive governmental leaders, planning not only to keep abreast of the spirit of the present, but courageously, even daringly, for the future.

Practical Mosquito Extermination Measures as Applied in New Jersey

By Frank W. Miller

Assistant Entomologist, New Jersey Agricultural Experiment Station

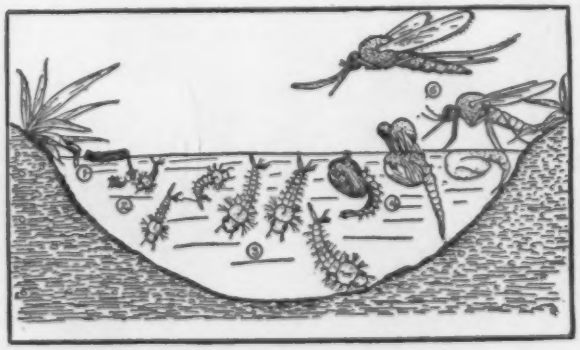
"Whiles in the air their clust'ring army flies,
That as a cloud doth seem to dim the skies;
Ne man nor beast may rest or take repast,
For their sharp wounds and noyous injuries,
Till the fierce northern wind with blust'ring blast
Doth blow them away, and in the ocean cast."

SPENSER'S "Faerie Queen."

HISTORIANS, as well as poets, from the time of Herodotus, have recorded the enmity of the mosquito to the comfort of man. It was not until the latter part of the nineteenth century, however, when the mosquito was found to be a carrier of disease as well as an annoyance, that measures for its control were devised. With this discovery came successful campaigns of extermination in Havana and Panama, conducted under the direction of the United States Government. These accomplishments will always hold high rank in the annals of modern sanitation.

Mosquito control having been practically demonstrated, many campaigns, with the same object in view, have been undertaken in this and other countries. In no place has it been developed on so large a scale as in New Jersey, the state that is now fast losing its unenviable appellation, "the Skeeter State."

The purpose of this article is to recount briefly the practical methods of extermination that have been successfully demonstrated in this state; but before doing so something of the life history of the mosquito must be known.



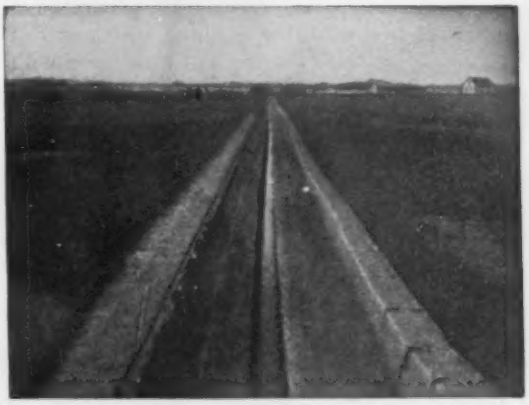
LIFE HISTORY OF THE HOUSE MOSQUITO
1. Eggs. 2. Hatching larvae. 3. Grown larvae or wrigglers. 4. Pupa. 5. Adults emerging from pupae and flying away

The mosquito must have water in which to breed. It will not breed in damp grass, thick foliage, dark cellars, or in dew. For its development, with the exception of a few types of mosquito, not prevalent in New Jersey, this water must be motionless or stagnant. The female lays her eggs, singly or en masse, dependent on the species, on the surface of the water or in mud periodically covered with water. The eggs

hatch into wrigglers, so small at first that they can hardly be seen with the naked eye. After attaining their full growth, which generally takes from six days to three weeks, depending on the temperature, they enter the pupa or final water stage. In about forty-eight hours the pupal skin cracks and the adult mosquito emerges in the form so familiar to every one. It rests on the shell long enough to dry its wings and then flies off to carry on its nefarious life mission.

Since it is an established fact that the mosquito requires water in which to breed, the conclusion naturally follows that if all standing or stagnant water be removed, mosquitoes cannot breed and will be exterminated. If the nature of the breeding place is such that it is impractical to draw off the water, filling is resorted to or oil and larvacides used to destroy the brood incubating at the time.

CUTTING A DITCH BY MACHINE ON THE SALT MARSH



A COMPLETED DITCH ON THE SALT MARSH, 10 INCHES WIDE AND 30 INCHES DEEP

The Problem of Drainage

The methods of drainage vary greatly, being changed to fit the needs of the area to be freed of mosquito breeding. One of the most prolific breeding places, when work first started in New Jersey, was the salt marsh extending along the entire coastal side of the state. The control of mosquitoes breeding from this source was imperative because, by nature, this type is capable of a flight range of one-half the state and, unless checked, breed in such countless numbers as to make life unbearable. The problem was to devise drainage systems that would provide adequate outlets for the water-covered meadows and at the same time permit tidal action in the ditches, thus preventing the water collecting there from standing motionless and inviting mosquito breeding. Fish, a natural enemy of mosquito larvae, would also be enabled to enter the ditches and devour such larvae as might exist.

If the meadow to be drained is fairly high and has an outlet of suitable proportions not too far removed, ditches 10 inches wide and 30 inches deep are dug at intervals, with spur ditching to drain salt holes in the vicinity. These ditches do not run dry as a rule, but are designed to allow a change of water with each tide. The width is not restricted to 10 inches, for sometimes it is found advisable to make ditches of multiple width.

NEWLY DEVISED DITCH-CLEANING MACHINERY FOR SALT-MARSH WORK

Often a survey indicates that a meadow is too low to permit of gravity drainage. In such instances the area is diked and automatic tide-gates installed. These close when the tide rises, on account of the pressure exerted by the tide without, and open when the tide recedes and the pressure from the meadow water within becomes greater. In this manner water is prevented from covering the marsh. Pumps

are sometimes used if the area is too low to be drained by the method mentioned.

Ditching in all cases is installed with patent hand spades or by special ditching machinery. Machinery is more practical on the larger areas, as it is much cheaper and faster than hand work.

Keeping the Ditches Open

After these ditches are dug, the problem of maintenance is encountered. Many million feet have been cut on New Jersey's marshes, and millions more will be cut in the next few years. Hand cleaning is slow, expensive, and not entirely satisfactory. As a result of cooperation between the New Jersey Agricultural Experiment Station and the Atlantic County Mosquito Extermination Commission, Fred A. Reiley, Superintendent of the Commission, designed, built, and successfully operated a practical ditch-cleaning machine. This machine is capable of doing the work of many men with better satisfaction and at a greatly reduced cost. Improved ditch-cutting machinery is being devised by the New Jersey Agricultural Experiment Station which will be tried out on the marshes during the coming summer and which bids fair to equal in success the ditch-cleaning unit.

While the salt marsh is in the first rank as a mosquito incubator, swamp areas, pools, ponds, over-grown streams, ditches and the like on the uplands are a constant menace to the success of a mosquito campaign. These are ideal breeding spots and are not overlooked by the mosquito. The swamps, pools, and ponds must be drained, oiled or filled in; the over-grown streams and ditches must be trimmed and thoroughly cleaned. These are engineering problems. In drainage on the upland, open ditching is generally resorted to, but where deep cuts are necessary pipe is used because the expense and difficulty of keeping these drains open is too great. In some instances ponds and lakes with grassy, over-grown banks become mosquito breeders. These places are stocked with fish, and the grassy banks trimmed to allow the fish free access to the larvae.

Breeding Places About the Home

Last, but not least, are the breeding places about the home that require attention. Rain-barrels, tubs, cisterns, tin cans, clogged roof gutters, cesspools, jardinieres, unused toilets, street storm-water catch-basins—in fact, any receptacle that will hold water long enough for a mosquito to breed—are potential mosquito breeders. The remedy is simple, effective, but too often neglected. If breeding is found in rain-barrels, dump them or screen the top; in tin cans, punch a hole in the bottom; if a cesspool, screen it tightly; if a roof gutter, clean it; if an unused toilet, flush it every ten days; if a street catch-basin, oil it. A cup of kerosene or of waste motor oil applied every ten days during the spring and summer months, so that a continuous film is formed over the entire surface of the water, will destroy breeding. People complain of mosquitoes on the porches and in the homes, yet it is often due to their own neglect that such annoyance occurs.

New Jersey has decreed that *the mosquito must go*, and New Jersey does not do things by half. The goal has by no means been reached, but enough has been accomplished to justify the thought that New Jersey may some day be better known as "The Skeeterless State."

City Planning Is Cooperation

CITY planning is the job of the whole community. City planning of some sort is going on whether we know it or not, whether we wish it or not. Every man who determines the shape or the use of anything in a city is to that extent a city planner.

But if we plan each for himself alone, we are like plants springing up too thickly and without choice of soil, each using most of its force in struggling with its neighbors and with bad conditions, rather than in producing its own fruit and its own beauty. So when we say good city planning, we mean merely our best reasoned attempt to give every city activity a fair chance, with the least number of misfits and the least amount of wasteful competition.

Our present way of living in this country is not an invention. it is an evolution. It has come to its present state through many centuries of experiment. It is far from ideally perfect, but on the whole it works.

We should test our proposed improvements and regulations, then, by the question: Will they work? That is, will they work, human nature being what it now is, and will they work as a part of the great experiment in government to which we are now committed, and which has not yet reached the limit of its useful growth?

No one man can answer even his own particular question from his own experience alone. Each specific problem is a part of the problem of our whole civilization. A city planner, therefore, is not a godlike person who from his infinite wisdom vouchsafes remedies for human ills. Rather is he an erring and humble man, doing his best to record the tentative necessary decisions of a large number of his fellows on common affairs. These decisions will be good just in proportion as they make use of all the knowledge in the whole community, wherever found.

—An editorial from the first issue (April, 1925) of *City Planning*, the new quarterly official organ of the American City Planning Institute and National Conference on City Planning. See the review of this publication on page 593 of this issue.

Economies Effected in Small Water-Works Plant

By R. G. Yaxley

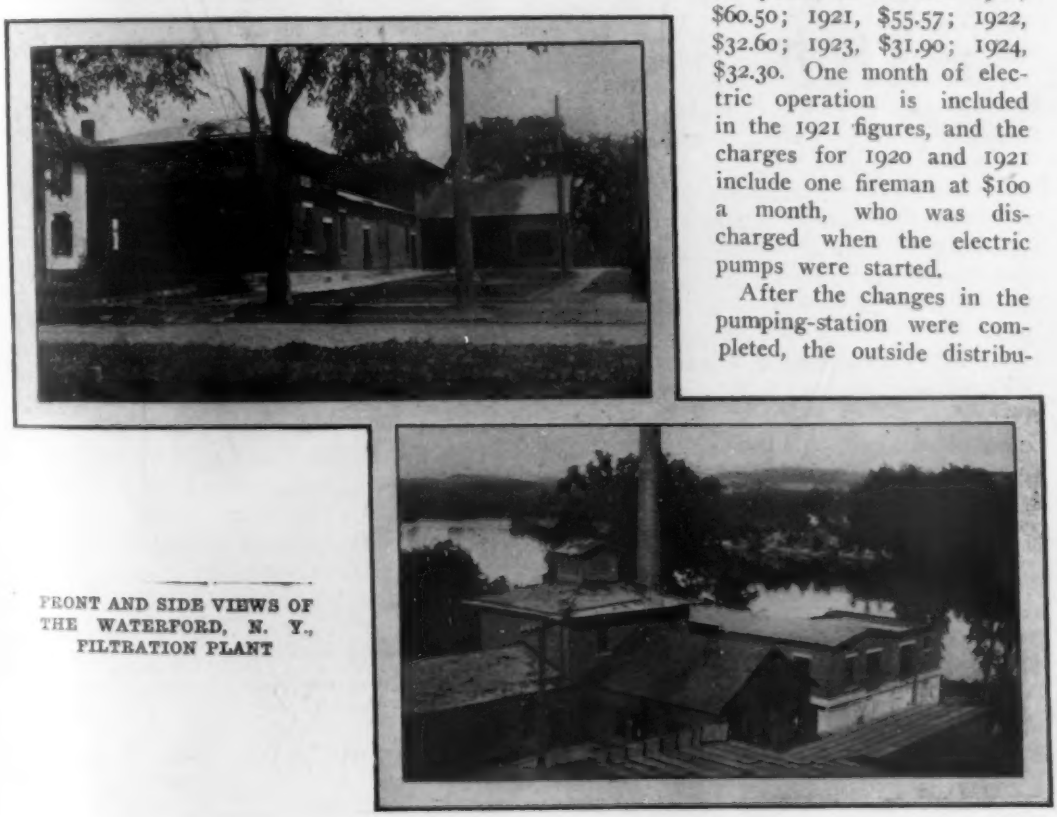
Superintendent of Water-Works, Waterford, N. Y.

THE town of Waterford is located in the southeast corner of Saratoga County, N. Y., and contains the oldest incorporated village in the state. The first water system was installed by a private corporation in 1885, furnishing raw water of a very poor quality. This continued until the works were purchased by the town in 1912. The town placed the control of the water-works with a non-partisan board of five commissioners, which, in 1914, constructed a modern mechanical filter plant of 2,000,000 gallons daily capacity and at the same time completely rebuilt the pumping-plant, installing two 125-horse-power boilers and two Troy engines on low-head centrifugal pumps, and rebuilding for high-head pumping the two Worthington compound, duplex pumping-engines.

The increase in fuel and labor cost during and after the war brought the operating cost to a prohibitive point, and after due consideration, it was decided to install motor-driven centrifugal pumps for both high- and low-head pumping, purchasing current from the local public utility at a straight rate of 2 cents per kilowatt-hour. Two 1½-million-gallons-daily pumps operating against a 260-foot head and two 2-million-gallons-daily pumps operating against a 40-foot head were purchased. These De Laval pumps are operated by General Electric motors. Each high-head pump is driven by a 100-horse-power, 2,200-volt motor, and each low-head pump by a 20-horse-power, 220-volt motor. There was also purchased a 15-horse-power motor operating a Root blower to agitate the filter beds while washing.

This equipment was installed in 1921. As a result of these changes, which cost $16,000, considerable reduction has been effected in the power cost per million gallons during the last five years, as follows: 1920, $60.50; 1921, $55.57; 1922, $32.60; 1923, $31.90; 1924, $32.30. One month of electric operation is included in the 1921 figures, and the charges for 1920 and 1921 include one fireman at $100 a month, who was discharged when the electric pumps were started.

After the changes in the pumping-station were completed, the outside distribu-



FRONT AND SIDE VIEWS OF THE WATERFORD, N. Y., FILTRATION PLANT

tion system was gone over as time permitted. The town has been nearly 100 per cent metered for a number of years, but a large quantity of water was unaccounted for, and the result of a thorough inspection of private services, blow-offs, etc., and a continuous follow-up of this work, is shown in the following table:

	Million Gallons in Town	Per Capita per Day
1920	195.5	122
1921	173.1	108
1922	139.9	87
1923	137.1	85
1924	121.6	76

NOTE.—The total population served is about 4,400, with a number of mills which use about 20 per cent of the water on the system.

In spite of this radical reduction in plant output, the amount passing through the meters has remained about the same, and, as would be expected from the foregoing data, the operating expenses have likewise decreased, as shown in the following table:

1920	$25,041
1921	24,794
1922	17,526
1923	14,185
1924	13,902

NOTE.—Pumping costs only per 1,000 gallons for the year 1924 are: electric power, $0.0305; wages, $0.0135; total $0.0440.

These expense items are all charges against the Water Department except new construction and interest and principal charges on the bonded debt. They include all office expenses, meter reading, distribution system maintenance, and operating charges, heat, light, insurance, and all wages and salaries. The total cash investment in the water-works is approximately $175,000 to date, and the bonded debt on September 1, 1924, was $92,000, which is being retired at the rate of $4,000 per year plus interest.

Treatment of Water

Filter plant operators will be particularly interested in the fact that the Waterford plant is using sulphuric acid for correcting the hydrogen ion factor. The source of the raw water is in the Hudson River, a stream very low in turbidity, but high in color from decayed vegetation. It is also very badly polluted by paper-mill wastes and sewage, gelatine counts of 25,000 per cubic centimeter and B. coli in 1/100-cubic centimeter being common. This, with the high color and other undesirable characteristics, demands a high rate of alum dosage, over 6 grains per gallon having been used at times in midsummer. The use of acid was started in February, 1924, and except for short periods when the alkalinity of the raw water was low, it has been used continuously since that time. The following table gives in tabulated form the results as compared with those of several previous years:

	Mar.	June	Sept.	Dec.
1919	2.4	3.28	4.7	2.3
1920	2.9	4.35	4.6	3.0
1921	2.9	3.03	3.4	2.2
1922	2.4	3.21	3.8	2.5
1923	1.9	2.66	5.2	2.1
1924	1.83	1.70	2.75	2.4
	Acid feed, corresponding m'ths, 1924			
	.61	.50	.60	.50

NOTE.—Acid costs about 30 per cent more than alum f. o. b. plant.

Another saving which does not show in the foregoing data is a reduction of about 20 per cent in wash water used and the almost complete elimination of hydrate troubles during the winter months.

Income

All water for fire protection and street and sewer flushing is furnished free, yet the income in 1924 was sufficient to enable the Water Department to pay $2,000 toward the debt charge, as well as to do over $2,000 worth of new construction. At the same time, the rates were not excessive, the maximum being 30 cents per 1,000 gallons, with no minimum or service charges. During 1925 the town will raise by general tax $7,000 for the Water Department debt, and in return for this will receive all water for fire protection and sewer and street flushing free. This does not seem unreasonable, as there are over 100 hydrants in the system, and this free service would surely equal that amount if purchased from a private corporation.

Summary

Three years of careful attention to details, both in the pumping-station and on the outside, plus the expenditure of a reasonable amount for new equipment, has reduced the expenses of a small water-works over $11,000, or nearly 45 per cent. A careful consideration of these data will show that over one-half of this saving must be credited to other sources than the new pumping machinery, and this was done with a system that was in first-class shape at the time the work was started.

Water-Supply Statistics

For valuable material see pages 376-409 of THE MUNICIPAL INDEX for 1925 and the February, 1925, and succeeding issues of THE AMERICAN CITY.

The Use of Infiltration Galleries at the Des Moines Water-Works

An Interesting Study of a Little-used Source of Water-Supply

By Charles B. Burdick
Alvord, Burdick & Howson, Consulting Engineers, Chicago

The Des Moines water-supply is obtained through a system of collecting-galleries, which constitute a horizontal well, so to speak, 2 miles in length, tapping a coarse sand stratum 15 to 20 feet in thickness. The water is derived almost entirely from infiltration from the Raccoon River, which roughly parallels the gallery system at a distance generally from 150 to 200 feet. The average daily pumpage at present is approximately 12 million gallons. The water is pumped from the gallery system directly into the city mains without storage and without secondary pumping. The gallery system has the ability to supply all peak drafts up to a present required peak rate of 26 million gallons per day, measured by the domestic and fire protection requirements.

THE present population of Des Moines is approximately 145,000. The growth has been comparatively uniform and moderate, from 11,000 in 1870, about the time the water-works was built. The average daily pumpage was 1.7 m.g.d. in 1884 and 3.2 m.g.d. in 1905. During the year 1923 pumpage rates were as follows:

	M. G. D.
Average 24 hours	11.8
Maximum 8-hour rate	19
Estimated peak for domestic requirements and fire protection	26

Des Moines is located at the junction of the Des Moines and Raccoon Rivers. The latter stream, on which the water-works is located, has a drainage area of 3,677 square miles and a minimum flow of 50 to 100 second-feet. The water-works is located about one mile from the mouth of the river. The collecting-galleries extend thence parallel to the river up-stream for a distance of about two miles. At the place of development the ancient valley of the Raccoon River is about one mile in width. The bottom and sides of the ancient channel are formed by impervious clays. The modern river has cut through the surface soils and runs on the top of the sand and gravel stratum that underlies the river.

The water-works was completed in the winter of 1871-72. The water was obtained from a circular well on the north bank of the river about 12 feet in diameter and 14 feet deep. As the quantity drawn was small, it was probably largely pure ground water. The pumping-plant was located about 700 feet north of the river. The water was drawn through a suction pipe and discharged directly into the mains. In 1876 two additional similar wells were built.

In 1882 a brick well 15 feet in diameter and 30 feet deep was sunk at the pumping-station. It furnished only about 500,000 gallons per day. The supply was immediately supplemented by a wooden collecting-gallery about 5 feet wide and 4 feet high extending from the bottom of the well toward the river, and upon reaching the river bank turning up-stream and closely paralleling the river. This gallery was open on the bottom, with open cracks between the planks on the sides, and was surrounded for a few inches with

screened gravel. In 1897, 2,319 feet of gallery was in use, supplying an average of about 2.5 m.g.d. In 1905, an additional gallery 1,000 feet in length was constructed, extending from the north bank of the river at right angles to the stream and crossing it, a total length of 1,000 feet. This gallery was connected to the suction well by a 36-inch siphon 600 feet in length, which operated successfully for fifteen years.

During the great majority of the time, the gallery furnished sufficient water for the requirements of the city. It was the custom, however, in emergencies to draw directly upon the river—in extreme droughts, or when fighting a large fire.

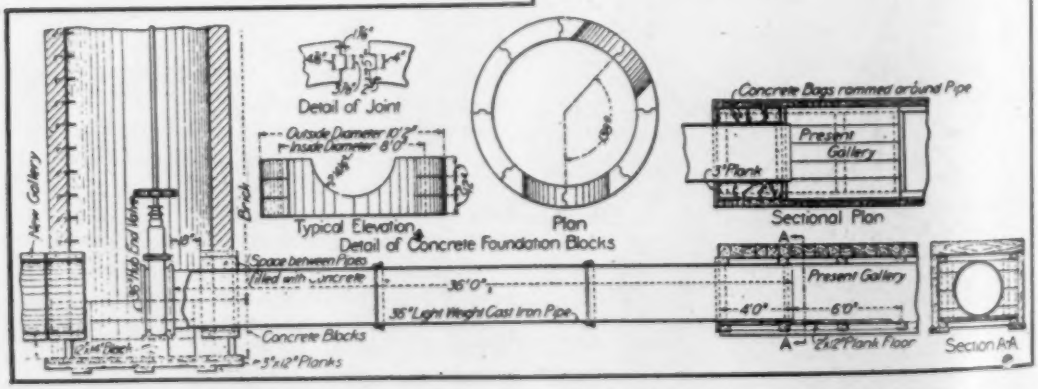
The Investigation of 1907

In 1907, the growth of the city demanding adidtional water, a thorough investigation was made as to the source of supply and the best means of increasing it. Up to this time it was supposed that ground water was being developed derived from rainfall without important additions of infiltered river water. At this time the average daily pumpage was about 3.5 m.g.d.

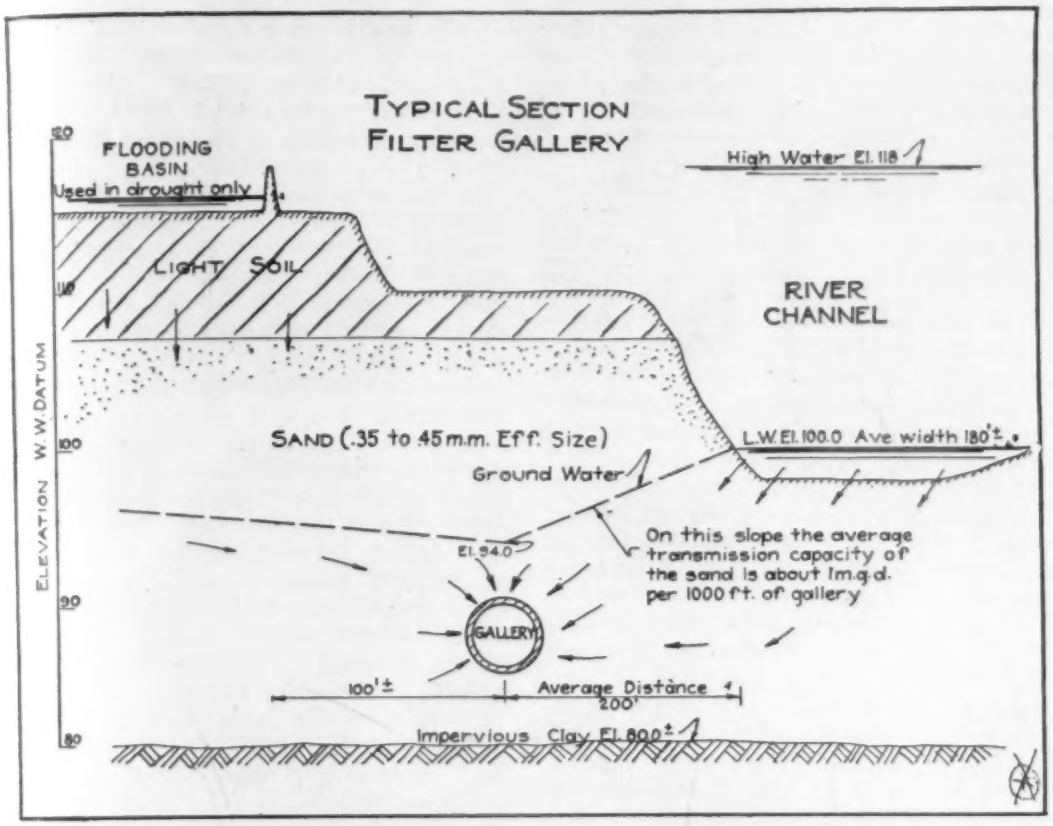
The bottom-lands from the water-works up to Valley Junction, a distance of three miles, were surveyed, and test borings were made to disclose the character of the alluvium, in which water-levels could be observed. The investigation showed, except in the vicinity of the collecting-galleries, that the ground water stood above the river surface under the land, and in general flowed toward the river, the axis of flow pointing slightly downstream. In the vicinity of the collecting-galleries, however, the ground water contours were depressed several feet below the surface of the river.

Evidently, if the supply was derived from rainfall falling directly on the land, there must be a sufficient gathering-area to furnish the supply drawn, and an adequate transmission capacity in the underlying sands to carry it from the place where gathered to the place where collected. The investigation showed that the gathering-area between the water-works and Valley Junction is about 3 square miles. If one-third of the rainfall should enter the soil and could be transmitted to the collecting-works, it was estimated that the supply produced could not exceed 1.5 m.g.d., or about one-half of the pumpage of that time.

The transmission capacity of the underlying sands was investigated by making numerous borings and determining the depth and effective sizes of the sand, and the average ground water slope. This information indicated that the average available slope parallel to the river valley was about 1 foot in 1,160,



DETAILS OF GATE CHAMBER 1 AND PRESENT INFILTRATION GALLERY IN DES MOINES
The upper right-hand diagram shows the reinforced concrete gallery



the effective size of the sand .42 millimeter, and the porosity was found to be approximately .33. From these data, it was estimated that the down-stream travel of the water in the sand was about 1.3 feet per day, which in the total cross-section of the valley available would produce not more than 185,000 gallons per day, or less than 1/20 of the pumpage at the time. It thus became evident that the greater part of the water must have been derived from another source.

The investigation further indicated that the ground water contours were depressed below the river surface for a length of about 7,000 feet of river, although through most of this distance the depression or negative head was comparatively slight. It was estimated that an average filtration rate of 100,000 gallons per acre of river-bed per day in that portion of it subject to negative head would be sufficient to account for the pumpage at the time. Records of leakage from canals frequently show much higher rates of infiltration than this.

There was other circumstantial evidence that the supply was derived largely from river infiltration. At times of high water the difference in level between the river and the water in the suction well was one foot or less. At times of low water this difference often reached five or six feet. At certain times the floods would leave the gravel-bars adjoining the river more or less coated with silt. From this occurrence the lost head was increased. When the water-levels in the gallery receded so low as to be considered dangerous, it had been the custom to "irrigate the river-bars," that is, to open channels in them. This materially increased the gallery water-levels, diminishing the difference between them and the water surface of the river.

As a result of this investigation, after considering other sources of supply it was determined that additional water should be developed upon the principle of river infiltration by extending the gallery parallel to the river and subjecting adequate areas of river-bed to the negative head necessary to induce filtration. This determination was made after a study of the quality of the water that had been produced and the nature of the underlying materials in which the galleries necessary would be built.

The Present Supply

At the end of 1923, 10,144 feet of col-

lecting-gallery was in use. The new gallery extends up-stream from the end of the old wooden gallery No. 4. Extensions have been made from time to time as follows:

	Feet	
Completed in 1910	1,500	
Completed in 1911	1,845	
Completed in 1917	3,480	
		6,825
Old gallery		3,319
Total gallery in use, 1917 to 1924		10,144

The new gallery consists of reinforced concrete rings or tiles 4 feet in diameter, 2 feet long, and 4 inches in thickness. These rings are laid on timber cradles to insure perfect alignment, and are laid butt to butt, leaving a ¼-inch space between rings, kept uniform by four lugs cast on each ring. After the rings are placed, the space between the ring and the sheeting and above and below the ring is surrounded by screened gravel having a thickness of 8 to 12 inches. The trench is then filled with the excavated sand, and the sheeting withdrawn. The bottom of the gallery conduit is about 14 feet below the low-water surface of the river. It roughly parallels the river bank at a distance of 150 to 200 feet. The necessary depth of cutting has varied from 25 to 35 feet. Manholes are located at all bends, extending above high water, and surrounded by embankments of sand to protect against leakage of polluted water. Gate-valves dividing the gallery into sections facilitate repairs. As yet no repairs have been necessary.

Gallery Capacity

Experience up to 1916 indicated the ability of the gallery to produce about 1 million gallons daily for each 1,100 feet of length of river subjected to negative head, during the governing drought periods. This is equivalent to about 220,000 gallons per day per acre of river-bed. Future additions to the supply planned at that time were designed upon the foregoing basis. It was then estimated that the old gallery system supplemented by the new gallery up to Station 6825, would furnish 8.5 m.g.d. In 1923 an average draft of 11.8 m.g.d. was secured from this system through a more extensive use of land flooding than had been resorted to previously. During the daylight hours the rate of pumpage, particularly in summer, occasionally reached 20 m.g.d., and greater peak rates could have been accommodated.

Land Flooding

Reference has been made to the previous practice of "irrigating the river-bars," at periods of low water, particularly when they were coated with silt. Thus, to disturb the river surface was regarded as of doubtful desirability, as tending to stimulate unduly the filtration at the point disturbed.

In seasons of ordinary wetness, the practicable draft is governed only by the carrying capacity of the gallery. The practicable capacity thereof has been governed by the ability to produce water in extreme drought periods, sometimes occurring at intervals of several years.

About ten years ago the experiment was tried, during a critical period, of pumping river water out upon the land, on the land side of the gallery, so controlling the flooded area that in general it did not approach the gallery closer than 100 feet. This experiment proved very satisfactory. It produced no noticeable change in the quality of the water and proved to be a means by which gallery water-levels could be brought up to any desired elevation by pumping a sufficient quantity of water upon the land.

The surface area underlying the flooded land varies in character. None of it is pure sand; most of it is sandy soil interspersed with some pockets of gumbo, which upon inspection would be deemed to be relatively impervious.

In the fall of 1922, which was the last period of excessive drought, water was pumped on the lands almost continuously at the rate of 5 m.g.d. from September to December, inclusive. During the year 1922, 1,293 million gallons were pumped upon the land. This is equivalent to 3.55 m.g.d. for the entire year, or 35 per cent of the average pumpage of the year. In ordinary seasons the land flooding has been less extensive, and practically no land flooding has been necessary during the present year.

In the drought period of 1922 the acreage subjected to flooding reached a maximum of 13 acres; the average unit rate of filtration was approximately 385,000 gallons per acre per day. At this time the flooded lands had not been cleaned since first used, six or eight years earlier. Weeds have been kept cut. Surfaces which were not in use were more or less covered with sod. Following the drought of 1922, additional flooding areas were prepared and the acreage formerly flooded was cleaned by shovels and wagons.

The engineers for the water department regard the flooding of lands rather as an emergency matter to tide over drought periods. It

is believed, however, that the practice can be extended, thus making the gallery collecting system somewhat more capacious than it has been considered to be in the past.

Storage

One of the important advantages of the present gallery system is the ability to produce water at a very high rate for short periods to meet the peaks of water demand, including fire protection. This ability arises from the practice of maintaining a water-level several feet above the top of the galleries under ordinary circumstances, thus storing water in the sand in close proximity to the gallery, which can be drawn upon to meet the peak rates. The storage, assuming that water in the amount of one-fifth of the volume of the sand drained, can be secured, is equivalent to about 6 million gallons for a strip 200 feet wide and 2 feet deep over the galleries. A much larger storage than this is actually available, particularly as the more the gallery water is depressed, the greater is the quantity of water drawn from long distances to the right and left of the galleries. The gallery system has met all requirements of peak demand for many years without resort to direct pumping from the river.

Quality of the Water

The water is moderately hard compared to eastern waters, varying from 220 to 340 parts per million total hardness, and averages about 280 parts. It contains some iron, generally less than 0.3 part per million. Iron deposit is noticeable when flushing the mains. It has never been of sufficient amount to cause serious complaint.

The river at present and for many years past has been seriously sewage-polluted. It has received a small portion of the sewage of Des Moines and all of the sewage of Valley Junction three miles up-stream; population 3,631. The bacterial content usually runs from 10,000 to 20,000 per c.c., although it sometimes falls to 100 or 200 for a few weeks in the cold season.

The water from the gallery system is clear and colorless at all times. It normally contains from 5 to 14 bacteria per c.c. on agar at 37 degrees. Coli are occasionally present in 1 c.c. As a precautionary measure, the water has been chlorinated since 1910, and is constantly observed by a full-time chemist and an assistant. The water department has one of the best water-testing laboratories in Iowa. As chlorinated, the water compares with the best filtered water, and the typhoid history, especially in recent years, has been very satisfactory. Only three deaths occurred in the three years past, and these are believed to have no connection with the water-supply.

Estimated Cost of Gallery System and Water Produced

As construction work has progressed over a period of forty years, it is impossible to present accurate figures of cost. The property, however, was appraised in 1912, and it is possible to present these figures supplemented by expenditure since that day. The appraised value of the old construction plus the construction cost of the new work, and including about 200 acres of land accommodating and protecting the gallery system up to Station 6825, is approximately $405,000.

The cost of the water developed is estimated as follows for the year 1923, during which 4,300 million gallons was pumped into the city mains:

		Total	Per M.G. Developed
Interest and depreciation at 6%....		$24,300	$5.66
Operating expense—			
Care and protection of water-supply, including laboratories and supervision	$16,285		
Power	3,307		
	$19,592		
Less profit on farm operations	1,736		
		$17,856	$4.15
		$42,156	$9.81

Although the construction estimated above was largely done prior to the war, a 5,000-foot extension to the gallery system nearing completion at the present moment is being carried out at a construction cost of approximately $30 per foot of gallery, which only slightly exceeds the prior construction costs. The above figures, therefore, may be taken as roughly representing present cost.

ACKNOWLEDGMENT.—From a paper read before the New England Water Works Association.

The Municipal Index for 1925

is ready for delivery. See page 577 of this issue.

Water-Works Improvements Without Bond Issues

By Frederic E. Beck
Chief Engineer, Consolidated Water Company, Utica, N. Y.

Read This Carefully

This article, prepared from a paper read before the New England Water Works Association, was not written with the thought that all water utilities can postpone construction, as was possible at Utica. The author feels, however, that in a great many cases if experts in water-waste survey or in the cleaning of water-mains were consulted, the construction of new works could be materially delayed and a large investment in capital, with the accompanying increase in operating charges, saved for several years. Read this article carefully and then consider the application of these very broad general principles to your own department or company, particularly if the available supply now seems to be inadequate.

IN 1917 the Consolidated Water Company of Utica,, N. Y., was face to face with the problem of increasing the amount of water available for use in the city and surrounding territory. The population was increasing rapidly owing to the location in Utica of large manufacturing plants engaged in the manufacture of war materials. The demand for water from the textile manufacturers alone was increasing so rapidly that it was imperative that steps be taken at once to increase the available water-supply.

The main source of supply of the Water Company is the West Canada Creek, and the water is taken from the creek through the Hinckley dam, a State Barge Canal storage reservoir, located about 21 miles from Utica. The water is transmitted by gravity, a distance of about 12 miles, through a cast-iron pipe of 24-inch diameter to a stand-pipe located on the hills north of Utica. At the stand-pipe the water is divided, and it is transmitted through two separate pipe lines to distributing reservoirs located on the hills surrounding the city. Plenty of water was available at the source, and the problem was simply to select the best and quickest method of providing an increase in the carrying capacity of the transmission main.

Construction Program Considered

The engineers engaged to study the problem submitted a report showing the construction necesary to obtain the required amount of water, together with estimates of construction and operating costs.

An alternate plan which called for booster pumps to increase the head on the present 24-inch pipe line was also considered, but was discarded in favor of the program which called for the construction of certain sections of the new transmission line each year. The construction was to begin at the dam, and as each section was completed it was to be connected with the present pipe line. In this way the required carrying capacity would be obtained with the minimum amount of construction each year.

The estimated future supply required, together with the amount of water available after construction, was as follows:

Year	Consumption M.G.D.	Consumption 20% Excess M.G.D.	Construction	Estimated Cost	Available Capacity After Construction
1918	12.	14.4	12,000 ft. 42" pipe	$ 375,000	14.8
1919	12.5	15.	13,300 " 24" "	167,000	14.8
1920	12.9	15.5	11,500 " 24" "	141,000	14.8
1921	13.2	15.9	9,500 " 36" "	197,000	16.0
1922	13.6	16.3	None		16.
1923	13.9	16.7	11,500 ft. 30" "	219,000	16.
				$1,099,000	

After this date the construction of the new pipe line was to proceed at the rate required to meet the demands for increased supply.

In the schedule just given, the 24,800 feet of 24-inch pipe was designed to parallel a line of 16-inch pipe in order to deliver a larger amount of water from the stand-pipe before mentioned, to one of the distributing reservoirs, and the 11,500 feet of 30-inch pipe was to form a new connection between this reservoir and the distribution system.

It will be seen that the construction pro-

gram necessary to produce the required amount of water to meet the demands of this six-year period would require a capital expenditure of $1,099,000. The interest charges on this investment, based on a rate of 7 per cent and not compounded, would amount during this period to $292,895.

That was a large investment for our company to make at this time and there was a question as to whether or not it would be possible to obtain the necessary materials and labor to complete the work in time to meet our requirements.

The foregoing has been related simply to give an idea of the problem and the method by which it was planned to meet it. We are in no way different from the majority of water companies and have no desire to spend large sums of money on construction work before it is actually needed, and therefore we gave the matter careful study.

Water-Waste Survey Instituted

During the time our engineers were preparing their report, it was decided to have a pitometer or waste-water survey made in a typical section of the city in order that we might obtain a better check on our consumption records, and to determine whether it would be possible to eliminate enough leakage from the system to bring the daily consumption within the limits of our supply. For this purpose the services of a company specializing in this class of work were engaged, and the survey was completed and the report submitted at about the same time as that of our engineers.

This report showed that a considerable amount of water was flowing into the section under observation, and that it was not being recorded by the meters, and must therefore be considered as water unaccounted for. It was decided that if this section were typical of the entire system, and that if the water unaccounted for could be located and the leaks repaired, enough water would be reclaimed so that our construction program might be delayed for one or two years.

After the consulting engineers engaged by the company had studied the report on the waste-water survey, it was decided to postpone new construction and to bend every effort to locate and repair all leaks in the distribution system.

Water Survey Justified

A force of engineers and inspectors was organized under the supervision of a man experienced in this line of work, and a thorough survey was made of the entire distribution system. At the end of the summer of 1919 we had located and repaired leaks amounting to a total of 1,700,000 gallons of water per day. Not one of these leaks could be located from the surface of the ground, as the water was in most cases finding its way into the sewers.

The survey was continued during 1920, and again the entire system was covered, with an additional saving of 800,000 gallons of water per day. We have made this work one of the features of our enginering department, and each year we check up our system and see that the water unaccounted for does not exceed that allowed in good engineering practice. We are now accounting for 86 per cent of our supply. Our system is fully metered and all of the supply mains are equipped with Venturi meters.

The following is a comparison of the daily consumption as estimated in 1917, the actual consumption after the waste survey, and the available supply as furnished by the original 24-inch transmission main:

Year	Estimated Consumption M.G.D.	Actual Consumption M.G.D.	Supply M.G.D.
1918	12.2	12.2	12.4
1919	12.5	10.8	12.5
1920	12.9	11.5	12.0
1921	13.2	10.7	11.5
1922	13.6	10.7	10.8
1923	13.9	11.0	*10.6

*Eight months.

A comparison of the figures just given shows some very interesting facts. It will be seen that if we add to the actual consumption figures the amount of reclaimed water, amounting to 2½ million gallons per day, the total would be practically identical with that of the estimated amount required. The fact is also clearly shown, that the available supply would not have equaled the demand during the year 1919, the supply and demand figures being equal, with no water in reserve.

Another interesting feature is the fact that the available supply is constantly decreasing, and that in a period of six years the carrying capacity of the transmission main had decreased by 1.8 million gallons per day, or a decrease of nearly 15 per cent.

It was further shown that notwithstanding the large saving of water lost through leakage, we should have been obliged to increase our supply during the year 1922. Knowing that it would be impossible to further reduce our consumption, the only answer was to increase the carrying capacity of our transmission main.

Supply Line Cleaned

A study of the transmission main, together with pressure surveys and investigations of the interior condition of the pipe, disclosed that there were apparently no large obstructions located in the pipe, the valves were all in good condition, and the pipe was not badly tuberculated. The inside of the pipe did, however, have a very thin coating of a slimy material which was not apparent to the eye when the pipe was dry, but which could be felt with the fingers on a wet pipe.

The value of "C" in the Hazen & Williams' formula having been determined by means of the pitometer to be but 90, it was determined to clean this pipe line and if possible postpone still further the construction of the new pipe line.

In October, 1922, the main was cleaned by the National Water Main Cleaning Company of New York, and measurements made one month after the cleaning showed that the value of "C" in the Hazen & Williams' formula had been increased from 90 to 131, and that we had, temporarily at least, increased our available supply of water by 3.8 million gallons per day—this again without the investment of capital.

At the end of 1923 the relation of our available supply to the consumption after the water-waste survey and the cleaning of the transmission main, was practically the same that it would have been had we proceeded with the construction program as considered in 1918.

The following comparison of costs is interesting:

	Construction Program		Pitometer & Cleaning Program
Year	Cost of Construction	Yearly Carrying Charge at 7%	Operating Costs
1918....	$375,000	¾ of yr. $ 19,687	$103
1919....	167,000	35,017	4,474
1920....	141,000	45,342	2,015
1921....	197,000	58,152	566
1922....	None	61,600	9,464
1923....	219,000	73,097	....
	$1,099,000	$292,895	$16,622

In this comparison of operating costs, interest has been taken at the rate of 7 per cent, with no allowance for depreciation or operation of the proposed new pipe lines. It has been assumed that during the year of construction, the interest time would be nine months.

The comparison of costs shows under the construction program a total expenditure of $292,895 for interest alone, as against a total operating charge of $16,622 under the waste survey, plus cleaning program, or a saving of $276,233 for the six-year period.

To-day we feel that we have exhausted all means for the increase of the available water-supply with no capital investment, and are now making plans to begin the construction program as outlined during the coming year.

County Operates Own Gravel-Pit

Scraper Runs Through Tunnel Under Road Between Pit and Plant

IN laying out a new highway, the Road Commissioners of Washington County, Wis., were forced by conditions to follow a route that passed across the county gravel-pit at West Bend. This crossing cut off more than half of the pit from the plant. It seemed likely that the construction of a public road across the pit would offer a permanent obstacle to the continuous operation of the Sauerman Crescent power scraper system that had been in use for several years to excavate and convey the sand and gravel to the plant, but the Commissioners found an ingenious way around the difficulty.

A concrete tunnel was built under the road at a point about midway between the two banks of the

pit, to furnish a passageway for the scraper. This slightly restricts the scraper's fredom of operation, but it is still able to convey to the plant all of the material required, which is about 400 cubic yards per day. This West Bend plant, which is one of several Washington County pits, produced over 30,000 cubic yards last season at a cost of about 48 cents per yard, including all charges for labor, supplies, repairs, insurance, and equipment depreciation. The previous season's record was practically the same, 35,994 cubic yards being produced then at a cost of 47 cents per cubic yard. Charles Johnson is County Commissioner, and E. A. Rosenthal Secretary of the Commission.

The Necessity of Municipal Meat Inspection

By R. A. Runnells, D. V. M.,
Department of Animal Pathology, Michigan Agricultural College

PEOPLE in general are becoming more and more concerned with what they eat. This is especially noticeable in cities where an inspection of restaurants, candy kitchens, boarding houses, and milk plants is maintained. In spite of the fact that meat forms about one-third of the diet (approximately 180 pounds per capita per annum) of our people, it is usually one of the last articles of food brought under the supervision of our municipal food inspection service.

It has been estimated that about sixty-five per cent of the animals prepared for food in the country are inspected in packing-houses in which the inspection is under the supervision of the Federal Meat Inspection Service. Statistics gathered at these houses show that certain percentages of the different species of animals slaughtered are affected with some disease or condition that renders them, either in whole or in part, unfit for human consumption. The owners of these abattoirs, of course, realize this and attempt to purchase only animals which they believe to be healthy. This means that the animals they do not buy are diverted to slaughter-houses where no such inspection exists. The result is quite obvious.

In some respects we Americans are a peculiar people. Our meat inspection laws are an evidence of this. Up until 1890 we had no national meat inspection laws to protect the health of our people. During the decade beginning 1880, European nations, realizing that we were not to a very marked degree particular about the condition of the meats we ate, decided to safeguard their own peoples by declaring an embargo against meats imported from our country. As a result our first Federal meat inspection laws were enacted. Therefore, the Europeans literally forced upon us a safeguard to health which we ourselves should have provided voluntarily. Even this first law was not aimed to protect our people, because it provided only for the inspection of export meat. Later, however, this law was extended so that it included also meat that was to go into interstate trade, but even to this day we have few state laws that require inspection of meats dressed and distributed within a state. Some few municipalities make provision for the inspection of this meat by enacting and enforcing municipal meat inspection ordinances.

The Purposes of Meat Inspection

The purposes of the meat inspection, as outlined by our Federal Meat Inspection Service, are fourfold:

1. To eliminate diseased or otherwise unwholesome meat from the general food supply.
2. To see that the preparation of the meats and products passed for human consumption is performed under sanitary conditions.
3. To guard against the use of harmful dyes, preservatives, chemicals or other deleterious ingredients.
4. To prevent the use of false or misleading names or statements on labels.

There is much confusion among people concerning the meaning of the word "disease" when applied to meat inspection. Perhaps it would be better to discard the word entirely and speak only of meat unfit for human consumption and of meat fit for human consumption. However, if we use the word "disease," we must bear in mind that there are different degrees and different types of disease and that possibly no animal is one hundred per cent normal in all respects. But that does not mean that every animal is not fit for food, any more than it would mean that an apple with a bad spot in it, or a bunch of grapes containing a few spoiled grapes on it, would not be fit to be eaten. What most of us would do in these latter cases would be to remove the bad spot with a knife or pick off and discard the spoiled grapes and eat the remainder.

Just so is it with the carcasses of food-producing animals. Many are the conditions which, when localized or walled off from the rest of the body, may be removed and leave the remainder of the flesh wholesome. On the other hand, these conditions may be so extensive that none of the meat is considered healthful for consumption. Still other conditions, no matter how slight they may be, may render the meat totally unfit for food. Therefore the inspection of meat must be placed only in the hands of individuals trained in

animal pathology, bacteriology, animal husbandry and allied sciences.

Examination of Live Animal First Step

When meat inspection in the United States was in its infancy, only dressed meats were examined. This is also the only inspection of meat that is required in some cities. While this is better than a total absence of inspection, it is far from being a perfect safeguard. A food-producing animal may be suffering from a condition that may render the entire carcass unfit for food, yet the appearance of the dressed meat alone may not reveal the condition. Hence, meat inspection should commence with an examination of the live animal. Then during the process of dressing, a careful examination should be made of the head, then of the viscera and finally of the dressed carcass as a whole. Of course, subsequent examinations should be made of the carcass and products prepared from it, because improper handling may bring about decomposition changes, or harmful preservatives may be added.

The importance of thorough inspection of meat is suggested when it is brought to mind that a number of infectious diseases of food-producing animals are transmissible to man. Belonging to this group are tuberculosis, paratuberculosis, pseudotuberculosis, actinomycosis, botryomycosis, anthrax, rabies, glanders, foot-and- mouth disease, variola, tetanus, malignant edema, septicemia, and pyemia. There are a number of infectious diseases of food-producing animals which are not transmissible to man, but for esthetic reasons and because of the fact that the keeping properties of meat from animals affected with them is very poor, they are not utilized for food in abattoirs where an efficient inspection service is maintained. Certain parasites of animals are transmissible to man. Pork and beef measles and trichinae belong to this category. The two former conditions are the precursors of two of the tapeworms which infest man.

An attempt has been made in this brief paper to state the purpose of meat inspection, to show the necessity for municipal inspection to cover the thirty-five per cent of meat originating in abattoirs not under Federal inspection, and to urge the enactment of municipal meat inspection ordinances.

—From *Michigan Public Health.*

How and When to Plant Trees

IN planting trees the first consideration is the soil, the climate, and the species. Thought must be given to the location of the tree, the space it will have in which to develop, and the variety that grows best in the vicinity. It is well also to consider whether it is not better to plant trees of long life, such as the oak or sycamore, instead of trees like the silver maple or poplar that mature after a short span of life.

It may be that in near-by wooded sections there are many young trees, saplings, or evergreens. This, of course, makes an easy source of supply, with the advantage of obtaining trees that live well in the vicinity. Experience shows, on the other hand, that it is often more satisfactory to buy nursery trees especially raised for transplanting. As a piece of general advice it might be said that evergreens of five feet in height and deciduous trees up to twelve feet, raised in a nursery, will give the best results.

Roots must not be bruised or allowed to dry, and moist earth should be kept around them until just before they are put in the ground. This is extremely important, because a few moments of ill-advised exposure of the roots to the sun, wind, or dry air will injure the future of the tree.

Broken or bruised roots should be pruned and at the same time the tops of the trees can be shaped up. The pruning should be done cleanly with a sharp pruner.

There are supporters of both spring and fall as the time for planting deciduous trees. Both have good arguments. If one were to lay down a general rule, however, it would be safe to say that all trees except evergreens can be planted at any time during the period between their going to sleep in the fall and awakening in the spring, and when the ground is not frozen. In the northern states the early spring is the best time for the inexperienced planter. Evergreens can be put into the ground in the late spring and during the latter part of August and the first of September.

A cool and cloudy day is the best for planting. In preparing the hole for the tree it should be made large enough to hold the roots extended normally. No air spaces should be left, and it is well to soak the soil around the roots. Most trees should be planted two or three inches lower than in the nursery.

There can be no fixed rules for spacing trees. Along streets they will range from 30 to 80 feet apart, depending upon the variety used. Except along highways, it is best to plant trees fairly near together, and the ones that crowd can be cut out later.

If the tree planter has not pruned his tree before putting it in the ground, it should be done immediately afterward. Frequently there is too little rather than too much pruning at the top The tree top should balance the root system. Many tree planters find it best to remove all the side branches of the deciduous tree, leaving only the leader or main shoot. This leader should not be pruned back in the deciduous variety. There is no need of pruning the top of evergreens at the planting time, and except in the case of some varieties of cedar it is undesirable.

—From a statement issued by Charles Lathrop Pack, President, American Tree Association, Washington, D. C., who will send to any one, for a two-cent stamp, tree-planting suggestions and a tree-day program for schools and clubs.

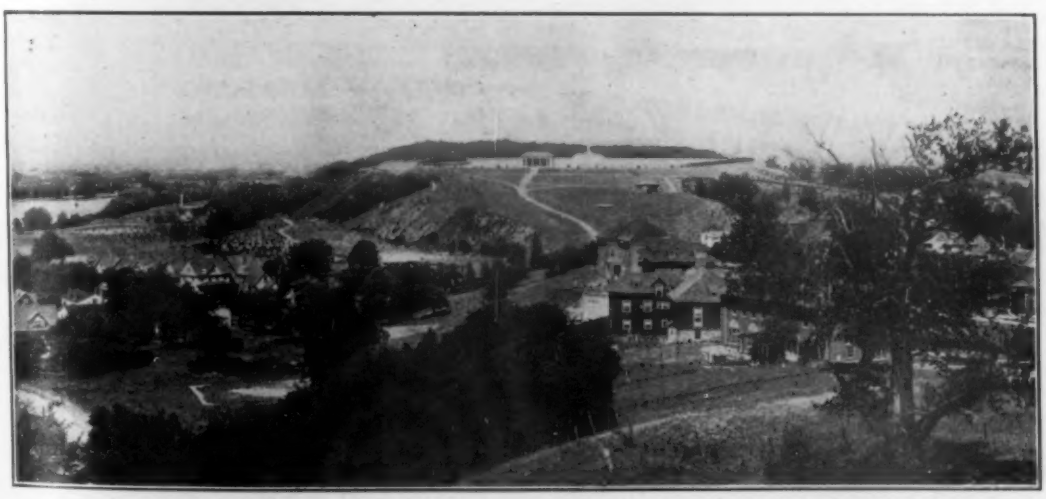
Sources, Conduits and Reservoirs of the Rochester, N. Y., Water-Supply

By John F. Skinner
Deputy City Engineer, Rochester, N. Y.

THE original source of supply for Rochester, N. Y., was Hemlock Lake, a beautiful, clear sheet of water 6½ miles long, ½-mile wide, and 86 feet deep. It lies between high hills 386 feet above and about 30 miles south of Rochester, and receives the rainfall from 48 square miles of watershed. The city acquired the right to use the waters of Canadice Lake, its neighbor on the east. This lake is of the same depth as Hemlock, about one-third the area, and lies 196 feet higher. Its watershed is 12.4 square miles, and its outlet stream has a watershed of 5.8 square miles. The combined watersheds of the two lakes and Canadice Outlet, if completely utilized, will yield about 33,000,000 gallons per day. The annual precipitation in this region for the last 48 years has averaged 28.3 inches. Experience indicates a net yield of about 500,000 gallons per square mile per day from the watershed. All of this supply is not available, as extensive construction in diking would be required.

Surveys are now under way in anticipation of the necessity of using the waters of Conesus Lake, which lies west of Hemlock Lake, and of Honeoye Lake, which lies east of Canadice. They are somewhat lower than Hemlock Lake, but their waters can also be obtained by gravity. Conesus Lake has a watershed of 69.06 square miles, and Honeoye Lake a watershed of 39.3 square miles. The total combined watersheds amount to 174.56 square miles. At the rate given above, fully utilized, this would produce 87,000,000 gallons per day. If 75 per cent of this amount is available during dry years, we shall have available 65,000,000 gallons per day. The present population of Rochester is about 330,000, and it has doubled in the last 25 years. The present use of water from this domestic system is about 86.4 gallons per capita, or a total of something over 26,000,000 gallons per day. These figures are complicated by the fact that a small portion of the population uses Lake Ontario water supplied by a private company. When all the available watersheds mentioned are reasonably utilized there will be an ample domestic supply for more than double the present population.

About 30 years ago the city began the purchase of property around Hemlock Lake, and later around Canadice Lake. The shores of Hemlock Lake were lined with summer cottages, and up to that time a sanitary pail system of collection of night-soil and garbage had been maintained by the city. The properties for 200 feet from the shore were purchased, and the cottages removed. In some cases whole farms were acquired. Plantations of conifers have since been made on the shores of both



A VIEW OF THE COBB'S HILL RESERVOIR, ROCHESTER, N. Y., COMPLETED IN 1908

EXCAVATOR USED IN MAKING DITCH FOR 37-INCH CAST IRON PIPE FOR ROCHESTER WATER-WORKS

Considerable "studding" was necessary on both sides of the trench because of the narrow bucket

lakes, and constant inspection maintains the purity of the supply.

The Reservoirs

At Rush, nine miles from the city, a storage reservoir was constructed in fill and excavation on a clay hill at the time of the construction of conduit 1. The side slopes are lined with riprap and the basin has a capacity of 63,400,000 gallons at 16.5 feet depth.

Mt. Hope, or Highland, distributing reservoir at the south side of the city was constructed at about the same time as Rush reservoir. At a depth of 15 feet it holds 22,500,000 gallons. It is built on a sand hill, puddle-lined, the lower half of the slopes riprapped to a 5-foot berm, and the upper half above the berm paved.

Another distributing reservoir was constructed in 1905-8 on Cobb's Hill, with water surface at the same elevation as Highland reservoir, namely, 125 feet above the central portion of the city. Cobb's Hill reservoir has a capacity of 144,000,000 gallons at 25 feet depth, and is lined on the bottom with concrete and surrounded by a gravity section concrete wall backed up on the outside by a heavy earthen embankment. There is in all the reservoirs an available storage, at the present rate of consumption, of about one week's supply.

Studies of the rate of consumption were made during the census weeks of the years 1900 and 1910. These rates, plotted, indicated that the use drops to a minimum of about 35 gallons per head, daily, and rises to a maximum of about 135 gallons. The mean consumption for the period of the test was 84.9 gallons per head per day. A single day's use during very hot weather was as much as 35,000,000 gallons.

The Conduits

There are at present three gravity conduits from Hemlock Lake, and the Canadice water is conducted into Hemlock Lake so that it reaches the city through the Hemlock conduits.

Conduit 1 was laid in 1873-4, and consists of cast iron and wrought iron pipe, with lead joints. For ten miles from the lake it is 36 inches in diameter. For the next 10 miles to the storage reservoir at Rush it is 24 inches in diameter, and laid to a steeper hydraulic grade. From Rush reservoir to the distributing reservoir in Highland Park, a distance of about 9 miles, it is 24 inches in diameter. Its capacity to Rush is 6,125,000 gallons daily, and from Rush 6,750,000 gallons.

Conduit 2 was constructed in 1893-4 and follows the same direction as conduit 1. After leaving the lake, however, it avoided the quicksand of the valley by tunneling through the high ground to the east. This section is a masonry conduit 6 feet in diameter, 8,000 feet constructed in tunnel and 4,000 feet in open cut. It is built to a gradient of 1 in 4,000.

The intake pipe for conduit 1 is about 1,000 feet long and 36 inches in diameter. The intake for conduit 2 extends 1,500 feet into the lake, and is 5 feet in diameter. From the lower end of the masonry section at overflow No. 1 the pipe lines of conduits 2 and 3 continue northerly toward the city.

Conduit 2 from White Bridge to Rush con-

sists of 38 inches riveted steel pipe from ¼- to ⅜-inch in thickness, and about 17½ miles in length.

Overflow No. 2 is about half-way between overflow No. 1 and Rush reservoir, and at this point the conduit rises to hydraulic grade. The conduit between overflows Nos. 1 and 2 crosses the Hemlock Outlet and Honeoye Creek ten times, and at these points is protected by concrete beneath the bottom of the stream.

From Rush reservoir to a gate-vault in Clinton Avenue South near the city, the pipe is riveted steel 38 inches in diameter, except for a short distance near Rush and at the crossing of the Barge Canal, where it is 36-inch cast iron. The total length is about 8 miles.

From this gate-vault, which is a junction point, conduit 2 continues to Highland reservoir, about 7/10 of a mile, as a 38-inch riveted steel pipe, and a 36-inch cast iron pipe about 1½ miles long runs to Cobb's Hill reservoir. The capacity of conduit 2 into Rush is 15,750,000 gallons and out of Rush 18,000,000 gallons daily. This difference is due to the fact that Rush reservoir lies above the hydraulic grade line connecting the ends of conduit 2.

Returning to overflow No. 1, at White Bridge, the northern end of the masonry conduit, conduit 3, constructed in 1914-18, commences as a 37-inch cast iron pipe and extends to Factory Hollow, a distance of about 7.7 miles. From this point it continues as a 37-inch Lock-Bar steel pipe through overflow No. 2, following the route of conduit 2 to Rush reservoir and thence to the gate-vault above-mentioned in Clinton Avenue South, a total distance of about 18 miles. Its capacity into Rush is 18,125,000 gallons, and out of Rush 19,500,000 gallons, daily. This conduit, the same as conduit 2, crosses the Barge Canal as a 36-inch cast iron pipe, where both pipes are enclosed in an accessible masonry culvert with gate-vaults and cross-connections to each end.

CURVE IN 37-INCH LOCK-BAR STEEL PIPE LAID IN 1917 AT ROCHESTER, N. Y.

MACHINE CALKING ON THE 37-INCH LOCK-BAR STEEL PIPE LAID IN 1917 FOR THE ROCHESTER WATER-WORKS

The combined capacity of these three conduits is 40,000,000 gallons into, and 44,250,000 gallons daily out of, Rush reservoir, and is sufficient to carry all the waters available from Hemlock and Canadice watersheds with such leeway as may be necessary in case any section is out of repairs.

All the conduits are laid in easements obtained by the city. The agreements in the case of conduit 1 provided only for construction and operation. Damages have to be paid to owners whenever excavations are made for repairs. The conduit 2 agreements were broader and covered the "right

to excavate, construct, operate and maintain a pipe or pipes, conduit or conduits, under, through and along said strip of land." The easements were 3 and 4 rods wide. Conduit 2 was laid 5 feet east and conduit 3, 5 feet west of the center line of the right of way. Where land was worth $30 per acre, about $100 per acre was paid for the easement. It is not fenced, but fences and gates are maintained by the water department at division lines crossing the right of way between adjoining owners. Where the conduit is laid in the highway, an easement is obtained from the abutting owner for his half of the road. About $1 per rod was the minimum price, when there was no damage to trees.

The construction of conduits 2 and 3 side by side, generally 10 feet center to center, the former in 1893-4 and the latter 20 to 25 years later, offers an interesting comparison of the combined cost of materials and construction. The cost of the right of way, engineering, etc., is excluded in both cases.

Conduit 2, 138,238.57 feet long, cost $1,226,-874.71. It is mainly 38-inch riveted steel pipe.

Conduit 3, 134,605.07 feet long, cost $1,173,-326.37. It consists of 7 miles of 37-inch cast iron pipe, and the remainder 37-inch Lock-Bar steel pipe.

These figures indicate that in 1893-4 the 38-inch conduit cost 23.4 cents per lineal foot per inch of diameter against 23.6 cents for the 37-inch conduit in 1914-1918.

This close correspondence is mainly due to the methods employed in construction. In the early 90's materials and labor were cheap and an army of workmen was employed, while, during the late war, men were scarce, materials and labor high, and consequently the work was largely done by machine.

Two other items of the design which contributed to more economical construction of conduit 3 were, first, the use of the Lock-Bar, rather than riveted steel pipe, which, because of a more efficient longitudinal joint, resulted in a 25 to 33⅓ per cent reduction in thickness where the pressure was high; and, second, the construction of a 37-inch cast iron pipe where under light pressure, at about the same cost as a 36-inch, by using a 36-inch Class D pattern with a 37-inch core, thus procuring a pipe 1.08 inches thick and weighing 418 pounds per foot.

ACKNOWLEDGMENT.—From a paper read before the New England Water Works Association.

Abstract of Report of Highway Research Board's Committee on Structural Design of Highways

THE report of the Committee on Structural Design of Highways, of the Highway Research Board, made by A. T. Goldbeck, U. S. Bureau of Public Roads, Chairman, in January, covered a number of interesting features.

Subgrade Investigations

It is believed that the introduction of such granular materials as sand, gravel, cinders, etc., in the subgrade not only tends toward reducing the capillary tension in the subgrade soil, but allows condensed moisture to be deposited on a subgrade made up of materials the bearing value of which is not so decreased by moisture; but as yet no very definite relation has been determined between capillary moisture as determined in the laboratory and the maximum moisture content which may be found in the subgrade under a pavement.

Design of Concrete Slab

The conclusions from a rather elaborate series of tests on the effect of static loads on road slabs were presented, showing that plain concrete of 1:3:6 mix offers resistance to impact ranging from about 60 per cent to 80 per cent of that developed by plain concrete of 1:1½:3 mix. In all cases the slabs tested appeared to offer a greater resistance to impact than to static load. In the field of motor truck impact, it appears that little impact is developed by pneumatic tires, even on rough granite block pavements. Solid tires, on the other hand, develop stresses ranging from 200 to 500 per cent of the static load stresses. Cushion tires, depending on their design, develop impact stresses between those developed by pneumatic tires and those developed by solid tires.

Fatigue in Concrete

Dr. W. K. Hatt of Purdue University noted the divergency which has existed in opinion as to the elastic limits of concrete. The conclusion was drawn that this divergency was probably due to the use of imperfect instruments, to the age of the samples tested, and to the amount of moisture present in the samples. The use of tests in this field of concrete which has aged from nine months to a year was recommended. The investigations of fatigue which were reported indicate that for specimens over six months old the endurance limit under reported stress is about 55 per cent of the static load capacity. Specimens aged 28 days cannot be depended on to have an endurance limit of over 40 per cent. Rest periods do not appear materially to affect the fatigue limit of well-cured concrete. Stresses above the fatigue limit cause progressive deterioration. From this it would appear to be desirable to so design concrete highways that the maximum loads which they must carry would cause maximum fiber stresses not to exceed 50 per cent of the modulus of rupture.

Record of Operation of the Fort Morgan, Colo., Municipal Power-Plant

By Ralph Johnston

ON December 21, 1924, the municipal water and light utilities of Fort Morgan, Colo., completed one year's operation of the new $190,000 electric power and lighting station, which, on January 1, 1925, was the highest pressure steam plant in the state. The plant carries 325 pounds steam pressure on two water-tube boilers.

The year's record shows that: (1) all operating and interest charges may be paid from current revenues; (2) during the next seven years it would be possible for the plant to pay into the city treasury the sum of $35,000 in lieu of taxes; (3) a fund of $100,000 may be set aside from earnings during the next seven years to provide for improvements, deferred maintenance, depreciation, and other items; (4) the total bonded light and water utility indebtedness of $223,000 may be paid from revenues in seven years.

THE FRONT OF THE FORT MORGAN MUNICIPAL POWER-PLANT

The city now has a plant capable of double the present output, thus making ample provision for city expansion. The rates charged for electrical current have been reduced, making the rate charged for electrical service as low as, if not lower than, that of any other city in Colorado. Further rate reductions, based on increased consumption of current, are possible without interfering with the seven-year program. The coal consumption has been reduced 33 per cent, and operating costs were reduced 10 per cent in the face of an increased load of 11 per cent for the year. Each householder is furnished electrical current free of charge for the lighting of a porch light.

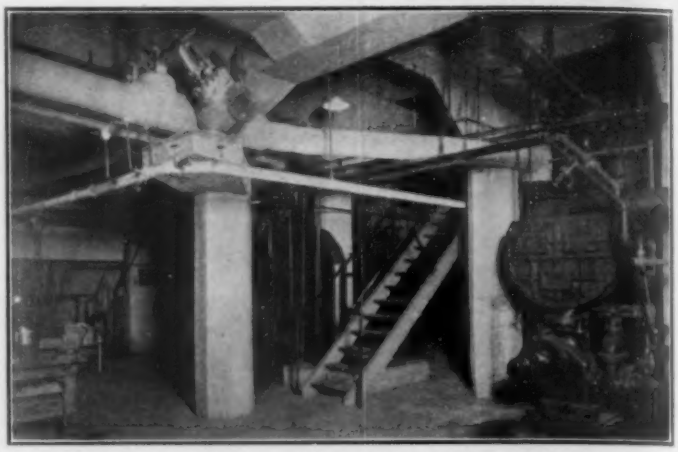
Fort Morgan is situated in Morgan County, Colorado, eighty miles northeast of Denver, in the rich, irrigated valley of the South Platte River. The main line of the Chicago, Burlington & Quincy Railway and a branch of the Union Pacific system serve the city with rail communication. The section is rich in historical interest, the city being the outgrowth of old Fort Morgan, a frontier outpost in the days when the prairie empire at the feet of the Rockies was being carved out. Fort Morgan's growth was coincident with the rise of the sugar beet industry in eastern Colorado. Its population is now about 4,000 persons and it is surrounded by one of the most fruitful irrigated sections of the agricultural West.

History of Utilities

From the beginning the city has owned its water-works and electric lighting plant. Reluctance on the part of private capital to risk investment in the new prairie towns was responsible for municipal endeavor from the first. In 1903 bonds were sold to provide for a water-supply system. Wells were sunk, a stand-pipe erected, and steam pumps used until 1906, when a 75-kw. engine and generator and the necessary boilers and other equipment were installed and electric lighting facilities were added to the city equipment. Both water and light were operated from the same power-plant and under the same management. This system is still in use to-day.

In 1922 it became evident that the time had come when a new and more efficient plant was needed despite the fact that the old plant had kept pace with the city's growth. After carefully considering the matter, the City Council

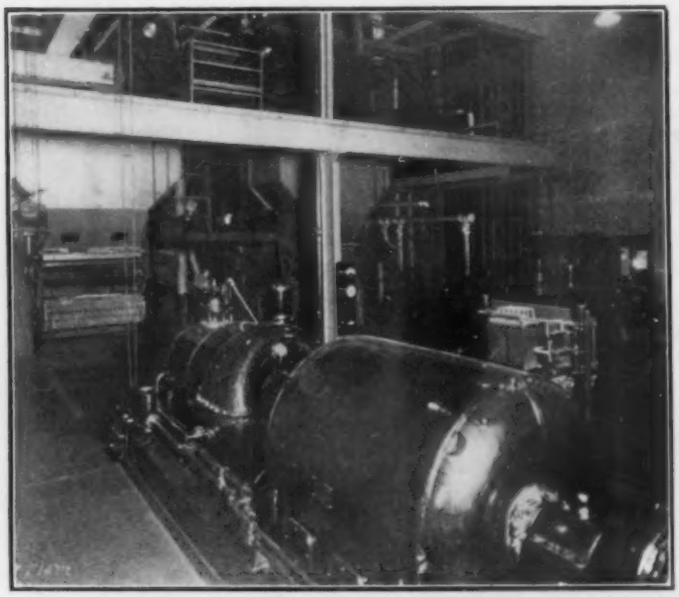
called upon engineers to make preliminary estimates of the cost of a new plant. It was decided at first to build a plant consisting of one new 1,000-kw. turbine and the 400-kw. turbo-generator then in use in the old plant. The estimated cost of the new plant was $160,000. With this figure in mind, the city asked a bond issue of $125,000, expecting the remainder to be cared for from earnings from the old plant. The bonds were carried easily and sold at par on a basis of 4¼ per cent.



BASEMENT FLOOR OF THE FORT MORGAN POWER-PLANT, SHOWING CONDENSERS AND STEAM PIPING

Plans were then prepared, and after careful consideration it was decided not to use any of the old machinery, but to build a plant consisting of two 1,000-kw. turbo-generators, boilers, and other equipment. Although the cost was increased considerably by reason of this decision, it was thought that by careful planning the money could be secured. The net result was that the new 2,000-kw. plant was built at a cost of $190,000. A total of $13,000 more was used in new line construction. The money in excess of the $125,000 bonds issue was obtained from plant earnings and the sale of old plant equipment, so that when the plant was completed it had only $125,000 in bonds against it.

After making the contract with the engineers, the City Council turned the matter over to the City Superintendent and the engineers. After the first meeting, when the contract was made, the engineers did not meet with the Council during the entire construction period. Because of the cooperation existing between all concerned, it was possible to build the whole system at a minimum of cost and without the letting of a single contract except for the purchase of equipment. This means that all the work was done by day labor, and it was done well. Practically the entire labor demand was satisfied without importation of workmen from other cities.



A VIEW OF THE TURBINES, BOILER FRONTS, FEED-WATER PUMPS AND APPURTENANCES OF THE FORT MORGAN MUNICIPAL POWER-PLANT

Equipment

The plant consists of two water-tube boilers carrying 325 pounds steam pressure with chain-grate stokers; motor-driven boiler feed pumps; two 1,000-kw. turbo-generators with surface condensers, auxiliaries, etc. The generators are wound for 2,300-4,000-volt Y operation with common grounded neutral. The boilers face the turbine on the same floor level and there is no divison between engines and boilers. This arrangement, together with the general arrangement of the plant, permits its operation with a minimum of labor, as shown by the following schedule: one chief engineer usually about plant during day; one helper on day shift to elevate

coal, dump ashes, etc., most of the time occupied with cleaning, painting up, etc.; one helper who comes on for part of the 3 o'clock shift to elevate coal, dump ashes, etc.; one engineer on 11 o'clock shift.

Whatever make-up water is needed for the boilers is provided by an evaporator. In consequence, there is no boiler cleaning except the washing with a hose once in two or three months. As a matter of fact, the purity of the water is such that it has been found practicable to introduce a small amount of raw water at certain times to prevent pitting of the boilers. The water for condensing is pumped from 16-foot wells put down at the site of the plant.

The average coal consumption per kw. hr. for the first year, which closed December 21, 1924, was four pounds of lignite. As the load increases, coal consumption should decrease to 3.5 or even 3 pounds per kw. hr. Because of the extremely poor load factor of the system, this is a satisfactory operation which will be susceptible of improvement from time to time.

The cost of current on the switchboard for the year was approximately one cent per kw. hr., not including fixed charges. The present output of the plant is slightly more than 2,000,000 kw. per year.

At the same time the new plant was being built, the entire distribution system of the city was remodeled and put in first-class condition. Instead of a 2,300-volt delta-connected system, the voltage was raised to 4,000 on the lines using Y connections on transformers with common grounded neutral. This increased the line capacity very greatly and has resulted in much better regulation.

Within three months after the new plant began operation, electric service rates were reduced 10 per cent. In addition to the low meter rate, each residence is entitled to a free porch or veranda light. This assists in lighting the streets and gives the town a progressive appearance in addition to furnishing householders better police protection. The street-lighting system is better than is usually found in towns of similar size.

Residence rates are from 9 cents down to 3.6 cents per kw. hr. with a monthly minimum of $1.40. The cooking rate is from 4 to 2 cents. Larger customer power rates go below 1½ cents. The service during the year has been excellent, and no power-house outages have occurred since beginning operations.

Statements for electric light and water are not mailed out to customers. The patrons come to the water and light office between the first and tenth of each month and are given a 10 per cent discount on their bills. This method has been used for fifteen years and has saved the city much expense in collecting accounts.

The result of this program as carefully carried out has resulted in rather remarkable financial benefits to the city, and the first year's operation may be summarized in the following income and expense figures:

Gross, electrical department	$81,850
Expense, electrical department	37,640
Net, electrical department	44,210
Gross, water department	26,097
Expense, water department	19,000
Net, water department	7,097
Total gross income	107,947
Total expense	56,640
Total net income	51,307

The only interest charges against the system amount to approximately $11,000, so it is clear that more than $40,000 is available for retirement of bonds, additions to property, and taxes or the equivalent.

The total outstanding bond issue for water and electrical systems is now $223,000. The total value of the system is estimated at $500,000.

In other words, it has been shown that the system may be kept in first-class operating condition and entirely paid for in seven years, with a very substantial addition to property.

The designing and execution of the entire system was made under the direct charge of Wood and Weber, engineers, Denver, Colo.

"The King's Highway Is Not to Be Used as a Stable Yard"

ONE of the most notable judicial utterances on the use of the public streets by standing vehicles was made in 1812 by the great jurist, Ellenborough, Lord Chief Justice of England. It was in the case of Rex. vs. Cross, in which the defendant was indicted for allowing his coaches to remain an unreasonable time in the public street. The Court said: "Every unauthorized obstruction of a highway to the annoyance of the king's subjects is a nuisance. The king's highway is not to be used as a stable yard." This authority has been repeatedly quoted with approval in American courts, including the New York case of Cohen vs. Mayor, 113 N. Y. 532-535, in which Judge Peckham said:

"The primary use of the highway is for the purpose of permitting the passing and repassing of the public, and it is entitled to unobstructed and unoccupied use of the entire width of the highway for that purpose, under temporary exceptions for deposits for building purposes and to load and unload wagons, and to receive and take away property for or in the interest of the owner of the adjoining premises, which it is not now necessary to more specifically enumerate."

Scheme to Encourage Paving by Installing Better Lighting

City Commissioners at Pueblo, Colo., Arouse Keener Interest in Paving

A NOVEL and helpful scheme for promoting paving and street lighting and the general beautification of the city has been developed by the City Commissioners of Pueblo, Colo. Whenever a paving district is finished, the city immediately installs a system of up-to-date street lighting of the ornamental type. The result has been to arouse a much keener interest in paving, for the paving and lighting together beautify the section and greatly increase property values.

STREET SCENE IN PUEBLO, COLO., SHOWING SINGLE-GLOBE STREET LIGHTS USED IN SOME OF THE NEWLY PAVED DISTRICTS

Since the plan was adopted, the city has installed 884 ornamental lights at a total cost of $83,000. Of the total number, 67 are of the cluster style, consisting of five lights mounted on concrete bases at the street intersections. The remainder are of the single ornamental light type mounted on steel posts along both sides of the street, arranged alternately so that the light is evenly distributed throughout the blocks. Five additional paving districts, 90 blocks, completed last fall, will soon be equipped with ornamental lights.

The only portion of the lighting expense borne by the paving district is the laying of the conduits and the bases, both of which can be done at little expense at the time the paving is laid. More than $2,000,000 has been spent in Pueblo for paving during the last two years. The lighting of the city is under the supervision of Fred E. Olin, Commissioner of Parks and Highways. We are indebted to Earl C. McCain,, Pueblo, Colo., for this information.

Recognized Types and Sizes of Paving Brick Cut to Four

FROM sixty-six to four recognized sizes and types of vitrified paving brick is the simplification record of the paving industry in the short period of four years, according to the recent announcement by the Permanent Committee on Simplification of Varieties and Standards of Vitrified Paving Brick of the United States Department of Commerce. At the meeting of the Committee on March 20, 1925, at Washington, D. C., the committee eliminated one of the five remaining types and sizes of brick, thus cutting down the official recognized list to four in number. The following are the recognized types and sizes:

	Depth	Width (As Usually Laid)	Length
Plain wire-cut brick (vertical fiber lugless)	3	4	8½
	3½	4	8½
Wire-cut brick (Dunn)	4	3½	8½
Repressed lug brick	4	3½	8½

The variety eliminated by the Committee, after a thorough study of the shipments for the entire industry for the year 1924, was the 3 x 3½ x 8-inch Dunn wire-cut lug brick. This particular variety had shown a consistent decline until it represented only 2 per cent of the total shipments in 1924.

Of the total 1924 shipments, 82.1 per cent were in the four types and sizes now recognized by the Committee. The most marked growth of any special variety of the recognized list was that of the 2½ x 4 x 8½-inch vertical fiber wire-cut brick. This size and type of brick increased from 2 per cent of total shipments in 1922 to 4.4 per cent of shipments in 1924. Reports from manufacturers indicated a decided trend toward a thinner brick for paving streets and highways for light or medium traffic.

It was the judgment of the Committee that the year 1925 would in all probability determine the value of this thinner brick and that including it in the recognized types and sizes could be given careful consideration at the 1926 meeting of the Committee.

The New Water-Supply of Phoenix, Arizona

By Frank A. Jefferson

AFTER eighteen years of investigation the city of Phoenix, Ariz., has solved its domestic water problem. The cost of rehabilitating the system was about $1,750,000. Instead of a highly alkaline underground supply, it now has a mountain water-supply, which is chlorinated at the reservoir site as a health-protection measure. The first problem in locating a new supply was to find one that would be ample twenty years hence and could be delivered to Phoenix at a minimum of expense. Five different sources of supply were investigated as to quality, quantity and feasibility. The various phases of the problem were studied by a number of engineers, including the late Hiram Phillips of St. Louis, Mo., who served as consulting engineer. The reports of these engineers finally were submitted after investigations extending over a period of eight years.

Savings Featured in Educational Campaign

In order to insure the passage of the bond issue, an educational program was planned, showing the advantages of the improvements and the savings to be effected. It was shown that the new supply would save the city the expense of operating the old city pumping plant, which cost $50,000 annually. The increased revenue to the Water Department was estimated at $15,000 a year, and savings in depreciation on the old plant amounted to another $20,000. There would also be another saving of $20,000 resulting from lowered insurance rates. This has already come to pass, as the National Board of Fire Underwriters has recently lowered the rates, giving an estimated annual saving of $105,000 a year. Against the savings listed in the educational program, the city charged $65,000 annually, as the interest on the bonds, for the project, and the annual operating expense of the Verde system amounts to another $8,000. The actual saving is about $32,000 a year at this time, with an increasing saving each year with the retirement of the bonds and the extension of the system.

When these issues had been properly presented to the public, a report on the proposed Verde gravity system was made. Samples of the water were sent to leading laboratories for chemical analyses, and then the right of the city to use the water had to be determined. Title to water in an arid or semi-arid section always is a matter of major consideration when digging is being done to appropriate the flows of streams for a given purpose. The problem of supply, therefore, was a duplex one, involving phases with which municipal corporations in most states do not have to contend. Phoenix established its right to the use of the water from the subsurface flow of the Verde, through court actions after its filings had been duly recorded.

LAYING CONCRETE PIPE FOR THE INFILTRATION GALLERY

A special bond election was held July 26, 1919, at which property owners of the city voted in favor of floating a $1,300,000 bond issue, to cover the original estimated cost of the work. The ratio in favor of the improvement was 26 to 1. By the time the city was ready to start actual construction, however, the prices of material and labor had increased to a considerable extent; the cost of the pipe

alone having advanced $281,000 over the figures quoted in April, 1919. This necessitated some revision in the plans, which were finally approved, and work started in January, 1920.

Nearly five years were spent in completing the system, the last work being done in May, 1924, on the chlorinating plant at the reservoir. From this time on, the citizens of Phoenix have used Verde water exclusively.

Source of Supply

The origin of the supply is in the mountainous district to the northeast of the city, 32 miles distant. Water is taken from the subsurface flow of the Verde River at a point near historic Fort McDowell. Although the flow of the Verde is normally clear and practically free from impurities at the point of intake, the water is permitted to filter through 150 feet of sand, gravel and boulders before entering the conduit. At no point is the water taken direct from the river, as the concrete pipe forming the infiltration gallery is laid parallel to the river and at some distance from it.

No hazardous construction problems were involved in the completion of the system, nor any that might interfere with the constant delivery of the water. The gravity system delivers the water into the city with sufficient pressure for all fire and domestic purposes, without the use of pumps.

It was originally planned to contract for practically all of the construction on the intake and pipe line. It was soon discovered, however, that with few exceptions it was practically impossible to secure satisfactory bids from reliable contractors, because of unsettled labor conditions. This fact was illustrated in the default of a contract let for the excavation for the 38-inch redwood pipe. The result was that all work was done under force account by the city, with the exception of a portion of the backfill, which was done under an informal contract. The work included excavations, backfill, right of way, sand traps, laying of pipe, concrete facing on the river bank, and road work.

Infiltration Galleries

The simple method employed in tapping the underground water of the river is interesting. The water is offered a path of less resistance through a big concrete pipe instead of forcing its way through the sand. Excavations for the infiltration gallery were made in the water-bearing strata, consisting of sand, gravel and boulders, to a maximum depth of 28 feet below the ground and about 15 feet below the underground water surface. Approximately 12,000 feet of concrete pipe, 5 feet in diameter, comprises the underground intake system. At the extreme northern end, 4,210 feet of pipe is laid with an open joint every 4 feet to give ingress to the water from the water-bearing ground.

The excavations for the intake were under water constantly and the workmen were compelled to remain in the water to complete their task. It was necessary in this work to divide the eight-hour day into two shifts—four hours wet and four hours dry. Despite the fact that a dragline machine was used to swing the pipe into place, the work was difficult and dangerous, as each joint of pipe weighed approximately 2½ tons. On an average, only about five lengths, or a total of 20 feet, were laid in an eight-hour day. Realizing the expense of hauling pipe for the intake system from Phoenix or of shipping it from an outside point, the city contracted to have it made on the ground. The pipe is made of concrete, heavily reinforced with steel, and is 5 feet in diameter, 6 inches thick and 4 feet long. Motor trucks were used in hauling the cement and reinforcing steel from Phoenix to the intake site.

THE SAND TRAP ON THE SUPPLY MAIN FOR PHOENIX, ARIZ.

A SECTION OF THE REDWOOD SUPPLY MAIN WINDING ITS WAY AROUND A STONY CLIFF, CARRYING WATER TO PHOENIX, ARIZ.

Gravity Supply Line

There were 119,162 lineal feet of 36-inch and 32,289 lineal feet of 38-inch redwood pipe used in building the gravity line from the intake to Phoenix. A total of $792,764.84 was paid for the finished pipe, which did not include the cost of digging the trenches or of the extensive hauling of material from Phoenix.

The redwood pipe is made of staves cut in the form of an arc, 1-9/16 inches thick and approximately 5½ inches wide, and varying in length from 12 to 18 feet. The staves are held in the form of a circle by steel bands ½-inch in diameter, spaced from 2¾ to 10 inches apart, varying according to the internal pressure. A total of 2,802,218 pounds of steel was included in the bands, shoes, nuts, washers, and clips used to tie the pipe securely and provide the necessary reinforcement. One hundred and eighteen freight cars were required to haul the redwood staves to Phoenix. There also were 39 car-loads of reinforcement material and two car-loads of valves and fittings.

Sand Trap

The water is carried through the intake pipe to a sand trap, at which point it is delivered to the redwood pipe line, through which it flows by gravity 28.7 miles to the junction with the city water-mains. The sand trap is a concrete building 20 feet square and 12 feet high. The floor is laid 2 feet below the floor line of the redwood pipe, with a sluice-gate on the side toward the river. Any sand that may be carried through the intake by the water is deposited on the concrete floor of the sand trap and is disposed of at infrequent intervals by opening the sluice-gate and flushing it into the river.

The redwood line was laid underground where practical, but there were stretches where it was not feasible to excavate, because of hard rock formations. At other points a path had to be blasted through the solid rock for the pipe. As an extreme example of the difficulties encountered—6 miles before the line reaches the intake workmen had to blast a mile of road and path for the pipe through almost solid rock. A small crew of Indian workmen were occupied six months in completing this mile of trench.

Reservoir for Peak Load

The present reservoir is located 6 miles from Phoenix on a 15-acre plot. It is lined and walled with concrete and entirely covered and enclosed to insure the purity of the supply. The reservoir site is sufficiently large for an auxiliary reservoir of 10,000,000 gallons. This was not intended as a storage plant, but is to provide sufficient water to care for the peak load on days of heaviest consumption. It is not intended to impound the water at any time for a period of more than 24 hours. All air spaces are amply protected by copper screening.

The construction records on the project show the remarkable fact that no workmen were killed, seriously injured or maimed during the period of construction, nor was any horse or mule killed or crippled. There were no premature blasts in the use of powder, no trucks or motor cars were wrecked, and there was not a single case of serious illness in the construction camp.

Water Purification for Small Cities

By H. V. Pedersen
State Sanitary Engineer, Des Moines, Iowa

IS it practical for a city as small as 1,000 population, so unfavorably located as not to be able to secure a sufficient quantity of safe and palatable water for public use from wells, to consider the installation of a purification plant and to develop surface water-supply? Any one answering this question definitely, either negatively or in the affirmative, might be accused of rather hasty decision, as one answer might be just as correct as the other. The correct answer as applied to a particular community depends largely upon local conditions and should not be made until all the determining factors have been carefully studied. But I shall go so far as to say that when a small city has become thoroughly dissatisfied with its old well supply and determines on a change, the development of a surface supply should in all cases be at least considered.

Every city, regardless of its size, should choose or develop the safest, most palatable, and most practical water-supply for public use that it can. A few cities in Iowa are so favorably located that they have no problem whatever in securing an excellent public water-supply. Nature provided an abundance of clear, safe water within easy reach, and the city water officials of the past needed only to dig a well, install a pump, and pay the power bill to fulfill the duties of their offices. It was so easy that it required no thinking, and it cost so little that the general public came to take it all for granted.

Many other cities, however, have not been so favorably located. Nature was not so kind to them, and they have been compelled to spend large sums of money in developing a well water-supply. Although the state as a whole has been blessed with an abundance of underground water, there are sections where this water cannot be considered a satisfactory public supply, because of the mineral content and objectionable tastes. Many of the shallow water-bearing sands are loaded with iron, and many of these sands lying beneath or adjacent to a city or town do not produce a bacteriologically safe water-supply at the present time.

The northern half of Iowa is generally thought of as an inexhaustible supply of unquestionably safe underground water. There is no question but that there is a large quantity of water, but it is amazing how rapidly this water is diminishing. Just what may be the cause of the lowering of the water-table is difficult to say, but we are inclined to believe that the underground water is being used up in a wasteful manner faster than it can be replaced.

The greater part of the northern half of the state is underlaid with a limestone formation. A well drilled down into this formation years ago was rarely cased below the stone. Many cracks and crevices have gradually opened and enlarged, because of erosion and exposure, allowing unpurified surface water to pass for long distances and contaminate a vein of water that has furnished the public water-supply. The majority of these deep wells produce a very hard water. Some of the waters are so hard and so full of iron, carbon dioxide, and other corrosive agents, that the life of the best well casing is not over twenty years. Thus it is that many deep wells which were once perfectly safe now produce a water which is contaminated and rendered unsafe from sources that are beyond human control.

Some Iowa towns have been trying for years to develop a satisfactory well water-supply. In the southern part of the state some cities have not been able to locate an adequate

New Supply vs. Old Supply

The author of this article, State Sanitary Engineer of Iowa, has had ample opportunity to study this question in detail. He states that it has been definitely proved in many states that the purification of a small surface water-supply is practical, and he goes on record as believing that when a city of 1,000 population and upward is dissatisfied with its public water-supply, it should at least consider the development of a surface supply before it spends a great deal of money in developing or adding to an already unsatisfactory supply. Readers of this article who are particularly interested in this subject should also refer to the article, "Planning the Financial Program for the New Water-Works in the Small Town," by Richard Messer, Chief Engineer, Virginia State Board of Health, appearing on pages 187-192 of the September, 1924, issue of this magazine.

well supply, and have therefore simply done without a public water system. Three cities within the last year, located in the southern half of the state, installed water purification plants as a result of long years of waiting. In the northern part of the state many towns have been getting along as best they could on hard, disagreeable-tasting water, for the reason that they believed there was nothing that could be done or that there was no way to obtain a more palatable water-supply. Several cities within the last year have installed softening and iron-removal plants which have proved satisfactory. The great majority of the towns, however, have continued to use a hard, impalatable, unsafe, and altogether unsatisfactory well supply because they are under the impression that it is impractical or impossible for them to consider the development of a surface supply, or do anything to improve their well supply.

For the benefit of those small cities in the state so located that they cannot secure a good underground water-supply, I am going to relate the experiences of several cities within the last few years.

Adel, Iowa, Turns to Surface Source

The city of Adel, with a population of about 1,500, did its best for years to put up with a shallow well water that contained a great deal of iron, was hard, and had a disagreeable taste. Finally the public refused to stand it any longer, and the Council decided to make every effort to secure a more satisfactory supply. All of the available underground supplies in the near vicinity were located and tested, with little success. After a careful search, a good, shallow water-bearing sand was located about 1¾ miles from the city, which furnished an excellent water. After the Council had deliberated and carefully considered the advisability of treating the water in the original old well and the development of the new shallow well proposition, it finally decided to construct a small rapid sand filter plant and purify the water from the Raccoon River, on whose banks the city is located.

A contract was entered into, and as a result the city now has a 120,000-gallon-per-day purification plant. The water is first pumped from the river to a small aerator, from which it flows by gravity into a coagulation basin 9 feet wide, 32 feet long, and 12 feet deep, where the water is treated with alum and allowed to settle. From the coagulation or settling tank the water flows by gravity through a sand filter 5 feet wide and 8 feet long, to a clear well beneath. This clear well has a capacity of about 4,000 gallons. From the clear well the water is pumped into the distribution system, which includes a storage or pressure tank. Liquid chlorine is injected into the water at the intake of the high-duty pump, to insure sterilization.

An argument might be raised as to the wisdom on the part of the city of installing the above-described plant in preference to developing the shallow water-bearing sands located 1¾ miles distant. It cannot be denied, however, that a very fine filter plant was secured at a total cost of about $11,000 complete, including the chlorinator. As it was estimated that it would cost about $25,000 to develop the shallow-well proposition, it is evident that the city made a considerable saving as far as first cost was concerned. Viewed from the eyes of the public, the City Council secured a good filter plant capable of furnishing a comparatively soft, clear, safe water for public use at a saving of $12,000 or more, and it is satisfied.

The Supply for Sigourney, Iowa

Now let us consider the city of Sigourney. This city, like Adel, also has had its troubles, but its experiences have been of an entirely different nature. It seems that on the advice of some local genius a Council some years ago carried a water-main a good five miles distant to a small river where a natural purification plant was to be developed. To make a long story short, the attempt to develop a natural filter was a complete failure, due entirely to improper advice and design. As no other supply was available and as the resources of the town had been completely drained, the city had to put up for years with the very unsatisfactory, dirty, raw river water, that could not be used for drinking or culinary purposes.

Finally a City Council determined to secure a better water-supply, and they brought a number of consulting engineers to advise them. Three engineers out of four advised the Council to install a modern rapid sand filtering plant, on the ground that the deep-well water would contain a great deal of objectionable mineral salts which would cause a taste. No amount of advice could move the Council or overcome the memories of the past sad experiences, and a contract for a deep drilled well was let. The deep well, drilled within the city limits, a pump-house and pumping equipment were installed for approximately $30,000. As predicted, the water from this well is very hard, and contains such an amount of mineral salts that it cannot be considered satisfactory for drinking purposes. The public are dissatisfied with the result and prefer to use private

shallow, contaminated wells instead of the public supply.

The city of Adel might have been able to develop a good shallow-well supply, but it chose to treat or purify a surface water, which in this case was the cheaper method. Sigourney might have developed an excellent surface water, but chose to develop the hard, impalatable deep water at great expense, because it believed a surface water could not be purified fit for drinking purposes, no matter what it might cost.

Filter Plant vs. Wells

Comparing the first cost of a filter plant and a development of a surface supply with a well proposition, it might be said that the former will as a rule demand a greater outlay of money. Natural conditions in some places tend to make exceptions to this rule, as in the case of Adel. In places where a well supply is impossible, a good surface supply is cheap at any price. Judging from the number of small cities that have been able to develop a surface supply successfully, we feel that it is safe to assume that the first cost is not prohibitive and that what one small city can do another might also do.

The one chief argument that discourages the development of a surface water-supply, is the operation. No one can deny that a water purification plant must be given careful, intelligent attention, or it will prove a failure. I do wish to emphasize, however, that a small city need not think that it must necessarily employ a high-priced engineer to operate a water purification plant. A conscientious, industrious, intelligent man may be placed in charge, and taught in an amazingly short time enough to insure satisfactory results. In the small city a plant may need to be operated but half of the day. The operator might therefore be a commissioner of streets, or be given some similar office whose duties can work in well with his duties as operator. It is evident that the larger the plant, the more time is required for operation, and naturally the various problems increase in magnitude, but the point is that a good, intelligent local man can be developed into a competent operator in a surprisingly short time if given an opportunity. No small city need continue to be without a public water-supply, or use a bad well water, for fear that it cannot find a man to operate a purification plant in a successful manner, provided it is willing to pay a fair salary.

The question of cost of operation also enters into the problem of deciding whether the development of a surface supply is practical. Much can be said on the subject, and it is no doubt true that it would cost more to operate a purification plant in some places than it would to operate a well supply. Every water-works system, no matter how simple it is, must have some sort of caretaker in charge. The majority of the public water systems of Iowa have caretakers who devote all the way from one to twenty-four hours per day to their work. It is not necessary to increase the number of men to take care of the average small city purification plant. The same intelligent caretaker that can look after a well system, could with a little more time take care of a properly designed purification plant. At Adel the operator spends about one-half of his time at the plant; the rest of the time he is taking care of extensions or acting as assistant street commissioner. It seems, therefore, that although the cost of operating a purification plant is greater than of operating a well system, it cannot be said that the cost is excessive or prohibitive.

The old idea that it is not practical to develop a surface water-supply should be corrected. Naturally, when a small city is so favorably located that it can secure a cheap, satisfactory well water, it would be foolish to consider the development of a surface water-supply. I am not thinking of such cities, but I am thinking of cities that are finding it difficult to secure an adequate, satisfactory well supply.

It has been definitely proved in many states that the purification of a surface water-supply is practical, and I wish to go on record as stating that when a city of 1,000 population and upward is dissatisfied with its public water-supply, it should at least consider the development of a surface supply before it spends a great deal of money in developing or adding to an already unsatisfactory supply.

ACNOWLEDGMENT.—From a paper presented before the Iowa Section of the American Water Works Association.

CIVILIZATION AND TAXATION

With the growth of civilization we are bound to devote a continually greater proportion of the social income to taxation. This is not necessarily unproductive. It simply means that with advancing democracy and increasing equality the satisfaction of our collective public wants plays a constantly greater role in our economic and social life. Just as the progress of the individual in culture and wealth is marked by the growing ratio of his immaterial to his material wants, so the progress of the community in all that really constitutes civilization is characterized by the increasing importance of the satisfaction of collective over individual wants.—Professor E. R. A. Seligman, in Proceedings, Academy of Political Science, January, 1925.

A Model Form of County Government

THE accompanying chart is from a recent pamphlet of the National Municipal League, by Richard S. Childs, entitled "The County Manager Plan, With a Review of the Efforts to Adopt it." The pamphlet is an effective argument for a form of government for counties based on the notable success of the city manager plan, but with modifications necessitated by the fact that the county is not strictly like a city but is somewhat more of an agent of the state, since its three most important officers—the Sheriff, Prosecuting Attorney, and Judge—are executing state laws and are supposedly arms of the state government.

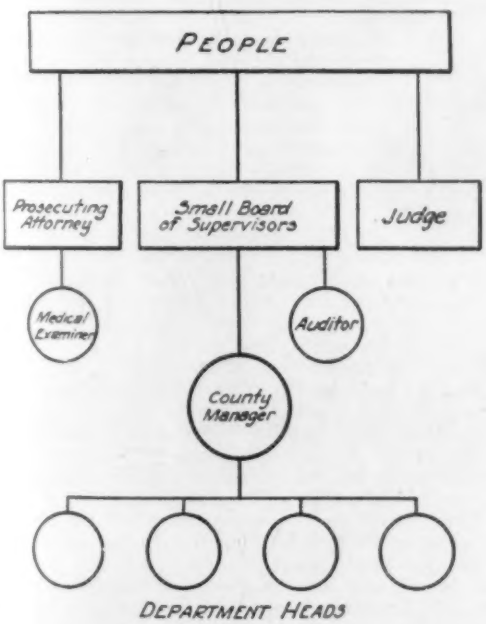
Mr. Childs' proposals do not deal with the problem of urban counties—those consisting mainly of a single city—nor with special conditions in the Southern and New England States, where forms of county government exist which are different from the prevailing type. With these exceptions, the author recommends the form of organization indicated by the chart, and outlines its essential principles as follows:

"The county manager plan in its correct form must provide the same factors of success that are found in the true city manager form, namely:

"1. *Unification* of all power (or as nearly all as possible) in a single elective board with full power to get results.

"2. *Short ballot*—only a very few to elect, so as to secure concentrated public scrutiny of candidates.

"The purpose of such a change in the form of county government is not to find a machinery that will automatically produce good government—no machinery so ingenious can be invented—but to get a mechanism so straightforward and compact in design that it is *capable* of cheap, swift, responsible action, and so *simple* that the ordinary voters can easily understand it and operate it by mass action on election day. To-day they are baffled by its complexity and obscurity and consequently leave the professional politicans—good or bad—in unchecked control. And boss rule is not democracy. Under a county manager plan the number of citizens who take part effectively in county politics will be instantly multiplied and the little group that have formerly controlled will find themselves swamped in a rising tide of a wide-spread and comprehending public opinion. And that is democracy and we must have it!"



MODEL FORM OF COUNTY GOVERNMENT

If county governments once became trustworthy and capable of taking on large tasks, they would, in Mr. Childs' opinion, speedily become great rural municipalities, solving many of the social problems of country life and bringing to rural dwellers many of the benefits of modern science which cities give to their people. For many desirable activities the county is the natural unit. The state is too big, too remote; the township and village are too small to be able to command expert service. But the county, comparable in population and in many of its problems to a city, united now by the automobile, the trolley, and the telephone, is a practicable working unit for real service of the kind the city man gets.

The activities suggested for an efficiently administered rural county are outlined in Mr. Childs' pamphlet. They include public health, hospital service, care of the poor, education, highway systems, technical and marketing services, and assessment for taxation. The pamphlet discusses also the county as an arm of the state and as a local government, and describes some of the recent efforts to bring about the adoption of the county manager idea in various parts of the United States.

Any one wishing to study the county manager plan as a route by which to open up this "dark continent of American politics," will do well to send 10 cents to the National Municipal League, 261 Broadway, New York, for a copy of "The County Manager Plan," by Richard S. Childs; and another dime for a companion pamphlet, "The New Kind of County Government," by Herbert Quick.

Methods of Financing Volunteer Fire Departments

THE following replies have been received by THE AMERICAN CITY to a letter recently addressed to the secretaries of a few of the state firemen's associations. The source of the reply in each case is indicated by the initial letter which precedes each paragraph under the several questions. Here is the key:

(A) D. W. Harford, Secretary, Connecticut State Firemen's Association, South Norwalk, Conn.

(B) Charles E. Clark, Secretary, Firemen's Association of the State of Pennsylvania, Wayne, Pa.

(C) Roy W. Alsip, Illinois Firemen's Association, Champaign, Ill.

(D) John A. Gross, Secretary, Minnesota State Fire Department Association, Red Wing, Minn.

(E) Fred A. Davis, Secretary, Firemen's Association of the State of New York, Fort Edward, N. Y.

(F) H. E. Strasser, California State Firemen's Association, San Diego, Calif.

The Questions and Answers

1. *What are the most successful methods in use in your state to raise money for volunteer fire departments?*

(A) Carnivals and fairs.

(B) Most companies have their yearly show, oyster or chicken supper, but I have found that the fair run by the company themselves is the best money-maker among them, although the turkey raffle is a big source of revenue in a great many localities.

(D) About the only methods that fire departments have for raising funds are the giving of dances, the sponsoring of baseball games, Fourth of July celebrations, and other public entertainments suitable to the community. Of these, the most common method is the giving of public dances, and especially masquerades.

(E) Minstrel shows, carnivals and balls.

(F) The most successful method used by fire departments in our state to raise funds is the annual ball. It is an affair that is looked forward to by the citizens, if properly conducted, which is the case in fire departments.

2. *If traveling carnivals are used for this purpose, has it been found possible to prevent the vulgar features and the games of chance which have proved very objectionable in many communities?*

(A) Yes.

(B) Traveling carnivals are not much in demand in this state, as the rough element that travels with them has caused a feeling against that method of raising funds. The one-horse circus is also out of date, for these concerns, being mostly flim-flam artists, got more than the home fire company.

(C) There are some good carnivals that have been engaged by different volunteers to help out their finances, and all have been regulated by the fire departments themselves in regard to games of chance and repulsive features.

(D) Traveling carnivals are used in a few instances, though the average village is not large enough to make a carnival profitable, and the revenue derived by the fire department sponsoring such an attraction would be very small. In cities of 3,000 to 10,000 population it is possible to do this under the auspices of the fire department and clear a little money. The regulating of attractions in the carnivals is a very difficult matter, as practically every carnival has some objectionable features, and unless village or city ordinances restrict them it is difficult to rule them out.

(E) I understand not.

3. *Do you believe that volunteer fire departments should be under the control of the municipal government and that the chief should be paid for his services?*

(A) Should be under municipal control; local conditions to govern pay or salaries.

(B) This is a question of pro and con. I have in mind townships where there are as high as five fire companies and not even a chief over them, each company doing its work under its own leader. From the view-point of good fire fighting, this is absolutely wrong and the companies would work better with a head. As volunteers they cannot get together on this question of a chief; hence, the township fathers should appoint a paid chief, and that would settle all arguments. I find that in cities of the third class, where three to fifteen volunteer companies exist, the paid chief is the only solution.

(C) I absolutely do, and from my observation the best results are obtained from a chief who receives a remuneration from the town or village board for his services. In regard to municipal control, some companies are amply taken care of by the city government in regard to apparatus, while others are wholly financed by the volunteers themselves, by shows, dances, carnivals and solicitation.

(D) I am fully convinced that volunteer fire departments should be under the control of the municipal government, and that the chief and assistant chief should be appointed by the council and paid a salary for their services. I would go even farther, and say that the village or town should set aside a certain sum of money each year for its fire protection. Out of this fund the volunteer firemen would be paid for whatever service they are called upon to render at fires; new equipment could be purchased from this fund, and replacements on old equipment could also be taken care of out of it. The time is not far distant when it will be almost necessary for the smaller towns or villages to adopt the budget system of running their municipal affairs, and the fire department will then be figured in as it should be.

(E) I always supposed they were under the control of the municipality. The chief should be

compensated for time spent in inspections, etc. This town pays the chief $10 a month, and that takes care of his time spent in work for the good of the department.

4. *Can you give us the names of any volunteer fire departments which are financed wholly by municipal funds?*

(A) Not wholly.

(B) The only company coming to my mind that would come near this question, would be the Swarthmore Fire Company. The borough owns the apparatus, the town hall where the fire apparatus is, and purchases all the equipment.

(C) Yes, Paxton, Tolono, Monticello, Rantoul, Farmer City, Mansfield, are a few of many.

(D) There are perhaps a dozen towns in the state of Minnesota where volunteer fire departments are financed wholly by municipal funds, among them being Austin, Owatonna, Albert Lea, Mankato, Red Wing, Moorhead, Crookston, New Ulm, Northfield, Faribault, Pipestone, and Brainerd. There are doubtless others. The fire departments in the towns just mentioned undoubtedly sponsor various events and attractions to raise money for their department treasury, but I am confident that the cities set aside a certain amount each year for the running of these departments, and pay their volunteer firemen for service performed. There are any number of towns and villages that do not pay their firemen any compensation for their work, and in my opinion this is a serious mistake, for many times a member will go out on the job with his best clothes on and have them ruined while working at a fire. This has a tendency to dampen the enthusiasm of the fireman and cause him to hesitate about performing fire duty.

Sometimes the Little Fellows Hold the Right of Way Too Long

Cartoon by Morris; protected by George Matthew Adams

CAUSES OF CONGESTION WHICH ARE HANDICAPPING CIVIC PROGRESS IN TOO MANY MUNICIPALITIES

The Present Sewage Disposal System of Rochelle, Ill.

An Old Septic Tank Remodeled and a Separate Sludge Digestion and Sprinkling Filter System Built

By Robert Isham Randolph
Consulting Engineer, Randolph-Perkins Company, Chicago

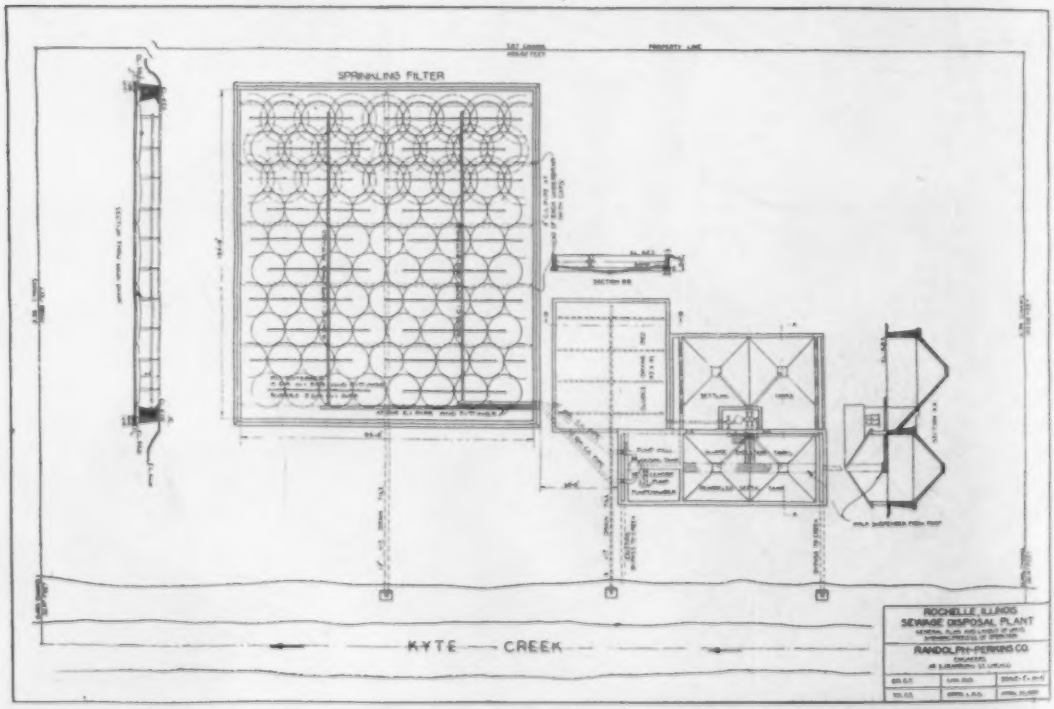
THE city of Rochelle, Ill., with a population of approximately 3,500, is served by a separate sanitary sewer system, constructed in 1907, emptying through an outlet sewer 15 inches in diameter into a septic tank with two compartments, each approximately 60 feet long, 10 feet wide, and 8 feet deep. It is highly probable that this tank turns out an effluent, at certain seasons of the year, that is worse than the raw sewage entering the tank, and the pollution of Kyte Creek by city sewage and other wastes has been the cause of frequent complaint throughout the last five years.

"Sewage purification" is a comparative term, and the degree to which it is necessary to purify sewage to prevent nuisance depends upon a number of collateral conditions. In order not to impose an unnecessary degree of refinement in the treatment of the city sewage, and a consequent unnecessary expenditure of public funds, the engineers first sought a ruling from the state authorities as to the degree of purification that would be required for this plant.

The Illinois State Department of Public Health ruled that "more than good tank treatment" was necessary, and the Division of Waterways of the Department of Public Works recommended "nothing short of secondary treatment." Primary and secondary treatment, as indicated by both of these authorities, was therefore adopted as a basis for the design.

Selection of Process

In the present state of the art of sewage disposal, several processes have been developed, but they all have a common purpose and they all do the same thing in different ways. Fundamental to each of them are several mechanical and biological divisions, as: coarse sedimenta-



GENERAL PLAN AND LAYOUT OF UNITS OF THE ROCHELLE, ILL., SEWAGE DISPOSAL PLANT, SHOWING PROCESS OF OPERATION

tion—mechanical; coarse screening—mechanical; fine screening—mechanical; sludge digestion—biological; aeration—mechanical and biological.

Before proceeding with the design of the plant, the engineers secured the cooperation of Dr. A. M. Buswell, Chief of the State Water Survey Division, in making analyses of the sewage and trade wastes tributary to the city sewers. A number of samples of raw sewage and of trade wastes were taken. Dr. Buswell's comment on the analysis of raw sewage at the septic tank is as follows: "There is nothing particularly remarkable about the analysis of the sample of raw sewage except perhaps the very high total solids. Otherwise, it is about what would be expected of a sample of sewage from a residential community."

The principal trade wastes entering the city sewers are liquors from the washing and dye vats of the Caron Spinning Mills, and the purpose of the investigation of these wastes was to determine whether they contained any acids or other elements that would interfere with the biological processes of the sewage disposal plant. Dr. Buswell's conclusion drawn from these investigations is that "there is no apparent reason why it could not be handled in the city disposal plant. If any difficulty is met with in the handling of these wastes in the municipal plant, it will probably arise from the fats and soaps. If such difficulty should arise, it would be a comparatively small matter to install grease-traps, and the recovered grease will, in a large measure, offset the cost of installation and operation of the traps."

Dr. Buswell's conclusions, as expressed above, indicate that the wastes from this plant may be handled by the city sewage disposal plant, but they also indicate the necessity for a thorough mixing of dye liquors and wash liquor in a tank to be provided at the Caron Spinning Mills, and the installation of a fine screen to remove the wool lint, either at the mill or at the city sewage disposal plant.

Field Investigations

Because of the proximity of a stone quarry and certain outcrops of rock in the Kyte Creek, it was thought advisable to make borings at the site of the proposed improvements to determine the nature of the excavation that might be encountered. For this reason the engineers made a number of borings with an earth auger at the points and to the depth of the proposed construction. No rock was encountered in any of these borings, and the estimates of cost of excavation were based upon the nature of the material revealed by the borings. The first borings disclosed a coarse sand underlying the top soil for a depth of 3 to 4 feet, and this suggested the possibility of utilizing this stratum as a natural sand filter. Further borings were therefore made over the area necessary for a sand filter, but the results were disappointing. The first sand discovered was apparently a pocket in the vicinity of the septic tank, and it did not continue as a uniform layer under the entire area. The only other alternative was the construction of an artificial filter.

Elements of Design

The present daily sewage flow from a population of 3,500 is estimated at 350,000. To provide for the normal growth of population, the plant is designed to treat the sewage from a total population of 5,000, with a maximum daily flow of 500,000 gallons.

The separation and sedimentation compartments provide a capacity of 2 cubic feet per capita and a detention period of two hours. The sludge digestion tank provides a capacity of 2 cubic feet per capita. The sludge bed provides a capacity of 0.35 square feet per capita. The sprinkling filters are designed on the basis of 20,000 population per acre.

The Plan

The plan is illustrated by the two diagrams.

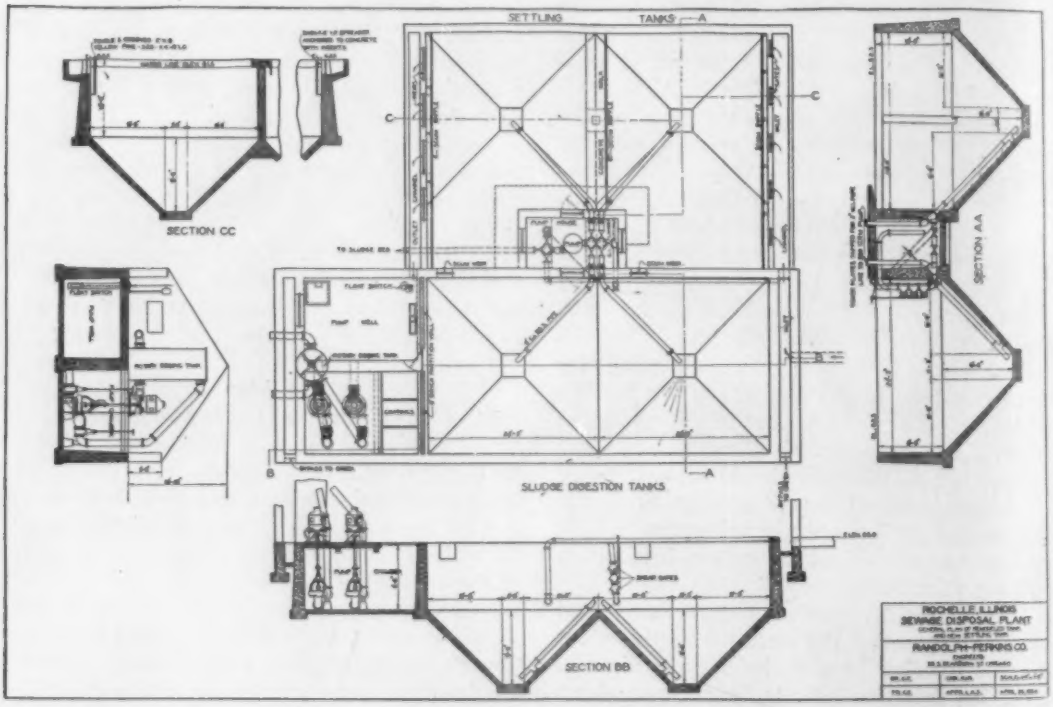
The present septic tank is to be remodeled for use as a separate sludge digestion chamber, and a new sedimentation tank is to be built next to it on the west side. The raw sewage from the 15-inch main sewer enters the inlet channel of the old septic tank as at present, but the present inlet ports are to be closed up and the sewage passed through a new opening into the inlet channel of the new settling tank. There are five inlet ports or gates from this channel leading into the tank, and a scum baffle in front of these gates to check the flow and aid in precipitation of solids. The raw sewage will flow through the settling tank from north to south, the period of detention being estimated at two hours. During this detention period the suspended solids will be precipitated into the two hopper-bottoms in the tank, and as this sludge accumulates it will be pumped through the sludge blow-off pipes by a 150-g.p.m. centrifugal pump into the sludge digestion tank. This pump is to be electrically driven, but manually operated, and the sludge will be drawn from time to time as it accumulates, so as to prevent septic action and bubbling or foaming in the settling tank. The pump operator can see the pump outlet, observe the nature of the discharge, and stop the pump when the discharge changes from sludge to clear water. Sludge will be

withdrawn from the settling tanks to the digestion tank daily.

The liquid sludge so stored in the digestion tank undergoes a biologic change, and by the action of the anaerobic bacteria the offensive and unstable elements of the raw sewage are reduced to an inoffensive and stable mineral residue. This digested sludge is drawn off from the bottom of the hoppers through the sludge blow-off pipes by the same pump that originally drew it from the settling tanks. Four gate-valves on the intake side of the pump control the suction from any one of the two

The ripened or digested sludge is pumped onto the sludge drying bed, where it is permitted to drain and dry out, and it is then disposed of as filling or fertilizer. In some plants a considerable local demand has been developed for this dried sludge as fertilizer. Another 6-inch suction line equipped with shear-gate inlets is provided to draw off the intervening liquor in the digestion tank between the sludge and the scum and return it through the 150-g.p.m. pump to the inlet end of the settling tank.

The liquid portion of the clarified sewage



PLAN OF REMODELED SLUDGE DIGESTION TANK AND NEW SETTLING TANK AT ROCHELLE, ILL., SEWAGE DISPOSAL PLANT

settling tank hoppers, and the two sludge-tank hoppers and two gate-valves on the discharge side of the pump control the discharge either to the digestion tank or to the sludge drying bed. There are risers from each of the four suction pipes to the pump-house floor level. These risers are provided with cover plates which may be removed to permit cleaning out the pipes with flexible rods in case of stoppage. The cover plates are also to be tapped for a 2-inch-diameter water-pressure line running to the 350-g.p.m. pump. This will provide a means for cleaning out the suction pipes with water pressure in case of stoppage and will also serve to agitate and loosen the settled sludge when it is desired to draw it off.

flows toward the outlet end, where any unsettled scum or colloidal matter is intercepted by a baffle in front of the outlet ports. This scum should be skimmed from the surface as it accumulates, and emptied into the sludge digestion tank through the scum weirs. The clarified sewage which passes under the scum baffle through the outlet weirs is collected in a wet well in the south end of the old septic tank. There is not sufficient head available at this site for the gravity operation of a sprinkling filter, so it is necessary to resort to further mechanical aids to the process. Next to the wet well is a dry well in which are installed two centrifugal pumps with a capacity of 350 gallons per minute and 200 gallons

per minute, respectively. These pumps are driven by electric motors operated by float switches, and deliver the clarified sewage to a dosing tank which alternates the flow through its two ports to the two halves of the sprinkling filter. This mechanical dosing tank was invented by L. K. Sherman of the Randolph-Perkins Company, and the first one built for the city of Chicago Heights is in successful operation.

The operation of the sprinkling filter is a combination of mechanical and biologic processes. The clarified sewage coming from the dosing tank is delivered through the pipe system to the sprinkling nozzles under a head sufficient to distribute it in a fine spray over the bed. It is partly aerated in the spray, takes up oxygen from the air, falls upon the rock bed of the filter, percolates through the interstices between the stones, absorbs more oxygen, deposits any remaining suspended solids, and is subject to the biologic action of the aerobic bacteria which form upon the filter and feed upon the microscopic organisms in the sewage. The reason for alternating the dose upon different portions of the bed is that these bacteria require air to sustain life. The dose must be applied gently so as not to wash the bacterial jelly from the stones, and there must be a period of rest between doses so as to permit the bacteria to grow. The liquid sewage, after undergoing this mechanical straining and biologic treatment in the filter, seeps along the floor to drains built in the concrete and covered with concrete slabs, whence it is conducted to a main floor drain and thence through a vitrified tile to Kyte Creek. There is no final sedimentation of the effluent from the sprinkling filter.

ACKNOWLEDGMENT.—From a paper read before the Illinois Society of Engineers.

The Paving on the Bear Mountain Bridge

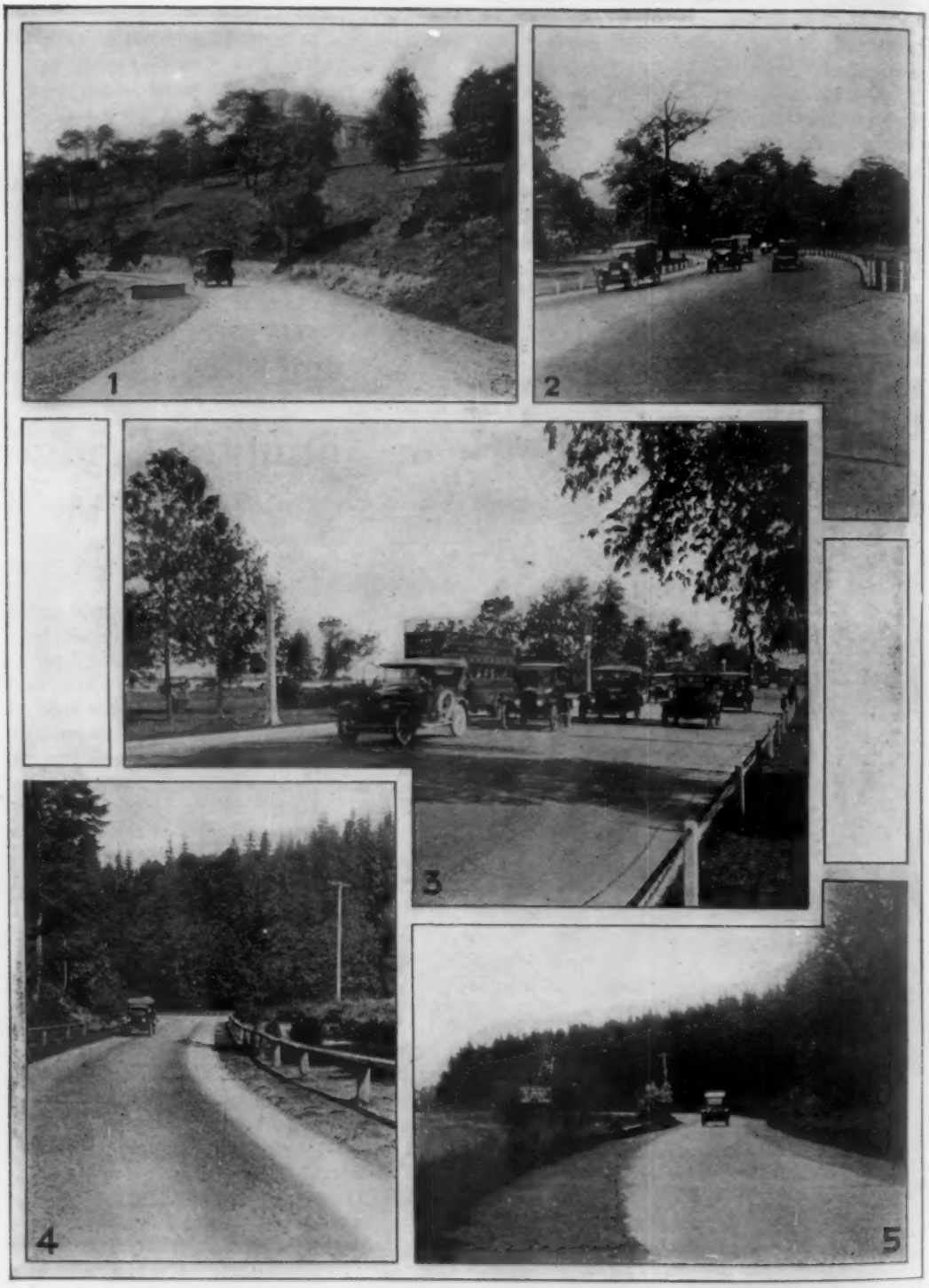
New Traffic Link Across the Hudson River Above Peekskill, N. Y., Paved with Asphalt

THE Bear Mountain Bridge is the first highway bridge to be built across the Hudson River south of Albany. It is located 45 miles from New York City, the nearest point to the city where a span of economical length exists. It is a steel wire cable suspension bridge with steel towers. The total length of the bridge is 2,257 feet between abutments. The suspended span is 1,632 feet center to center of towers. The approaches are independent spans, the east approach is one 210-foot truss, and the west approach comprises one 210-foot and one 100-foot truss span and two 50-foot plate girder spans. The towers are of steel, 350 feet high above foundation piers. The cast steel cable saddles at the top of the towers are fixed, and the movement of the cables due to variations in load and temperature is taken up by the elasticity of the towers. Each cable is 18 inches in diameter, made of 7,252 straight galvanized steel wires.

VIEW ACROSS BEAR MOUNTAIN BRIDGE ON OPENING DAY, LOOKING WEST

A single roadway, 38 feet wide, is paved with Bermudez asphalt carried on a base of concrete 6¼ inches thick, reinforced top and bottom with 9/16-inch iron rods spaced 4 inches and supported by steel stringers. The reinforcing rods run the entire width of the roadway without splicing and are bent up into the curb of the sidewalk. The roadway is of sufficient width to allow five automobiles to cross the bridge abreast. The Municipal Construction Company of Utica were the contractors for the asphalt roadway on the bridge. The Terry & Tench Company, Inc., were the general contractors for the bridge until December, 1923, when the work was taken over by the Tench Construction Company.

Concrete Driveways in Various City Parks



1. Riverview Park, Pittsburgh, built in 1921. 2. Drive in Forest Park, St. Louis, built in 1914 and under constant traffic since. 3. Sheridan Road, Lincoln Park, Chicago; this section, 54 feet wide, takes northbound traffic only. 4. Mukilteo Road, City Park, Everett, Wash. 5. The Presidio, San Francisco; concrete drive built in 1910

Forward Steps in City and County

How Louisville Voted Two $5,000,000 Bond Issues for Sewers and Grade-Crossing Elimination

LOUISVILLE, KY.—Like many other cities, Louisville has just grown, with little or no attention ever given to the future—no plotting, planning, or scheming. The inevitable resulted, and not the least annoying objection was the fact that railroads and tracks were everywhere through the center, to the east, west and all around the town. These tracks had been causing delays and accidents for years, and the insistent demands for removal had nearly reached the point where they were looked upon as jokes.

The necessary steps to be taken for the elimination of grade crossings made the job look hopeless. Legislative action had to be secured—and it was not a small undertaking. The Elimination Act permits the city to order the removal of crossings and apportions the cost on a basis of 65 per cent for the steam road affected, and 35 per cent for the city; and if a street railway is benefited, it must stand 40 per cent of the city's share.

The right to do the work having been secured from the Legislature, the next step was to raise the money. Of course, bonds were the only feasible way. Ordinances by the General Council of the city had to be passed. These ordinances specify rather fully how the work is to be supervised and the money spent—and contain the usual safeguards.

The next step was to obtain the consent of the electorate. It is necessary to have two-thirds majority of those voting on a bond project. At the last election there were three local bond issues and one state bond issue on the ballot, and considerable confusion was apprehended. The Round Table, composed of representatives of the various dinner and business clubs, realizing the importance of the local bonds, decided to get behind them and the organization that was perfected functioned without a hitch. Speakers for the sewer bonds, park bonds and grade elimination bonds were provided for meetings of the various civic, dinner, and trade clubs; in fact, no gathering was overlooked. Talks were made to workmen in the factory, to children in school, and women in sewing-circles. The mails were used for circulars, and altogether a rather thorough canvass was made with an unusually small expenditure. Posters of a convincing nature were placed in advantageous positions,—including show-

ONE OF THE POSTERS USED IN THE LOUISVILLE CAMPAIGN FOR GRADE ELIMINATION BONDS

windows in the retail district and the voting booths,—keeping the need before the people.

The park bonds were defeated, but the sewer and grade-crossing elimination bonds carried by large majorities. Before many years pass by, Louisville will rank high in civic improvements that add to the beauty and convenience of the city and the safety and health of its people.

THOS. B. CRUTCHER,
Chairman, Board of Public Works.

Kitchener Officially Adopts a City Plan; Town and Township of Waterloo Cooperate

KITCHENER, ONT.—Most provinces in Canada have enacted town planning legislation of a more or less comprehensive nature, but recent activity in town planning seems largely confined to the provinces of British Columbia and Ontario. In the former there is no special town planning legislation, but under recent provisions of the Municipal Act certain zoning powers have been provided. The city of Vancouver is making preparations to take advantage of the proposed City Planning Bill which has been presented to the Legislature.

Of the city of Kitchener in the province of Ontario it has been said:

"Canadian town planners will take courage, in the midst of much cause for discouragement, from the fact that at last a Canadian city of the size and importance of Kitchener has passed into law a comprehensive town plan for the regulation of its future growth and development on the scientific lines advocated by town planning science."

The Ontario Planning and Development Act gives considerable powers to urban centers over new development, which powers in the case of a city extend within five miles of its boundaries. Under the provisions of such act, the Council of the municipality may delegate its powers to a Commission. This has been done in the case of a number of cities and towns, amongst them being the city of Kitchener. Under the act the Planning Commission has jurisdiction over new subdivisions and can make suggestions for changes in the street system and for the location of parks.

Other town planning powers under the control of the Council are contained in several other acts, but principally in the Municipal Act. Where Town Planning Commissions have been appointed in Ontario, however, they generally act in an advisory capacity in all matters relating to planning. In the case of Kitchener, the plans of proposed development were prepared by the Town Planning Commission, but where any change is to be made that involves the acquiring of land or the payment of damages, it can be done only by the City Council.

The Zoning By-Laws prepared under the auspices of the Planning Commission were passed by the Council and approved by the Ontario Railway and Municipal Board. Changes can be made only by the passing of an amending by-law, which must have approval of the said Board. This does not provide the flexibility of a local board of appeals, but at least has the advantages of stability.

While the city of Kitchener has jurisdiction for the laying-out of new subdivisions within five miles from its limits, it has no control over building development outside its own boundaries. The adjoining town of Waterloo was persuaded, however, to plan at the same time, and now the whole of the township of Waterloo, in which the city of Kitchener and the town of Waterloo are centered, is also being planned. It is expected that the zones established in the city of Kitchener will be protected by zones in the town of Waterloo and in the township of some 128 square miles, and that adequate building restrictions will be imposed.

Thomas Adams was the consultant for the Kitchener plan, the writer being associated in this work and being consultant for the town of Waterloo and the township of Waterloo. A. R. Kaufman is Chairman of the Kitchener City Planning Commission; Dr. W. L. Hilliard of the Waterloo Town Planning Commission.

HORACE L. SEYMOUR, C. E.,
Vice-President, Town Planning Institute of Canada.

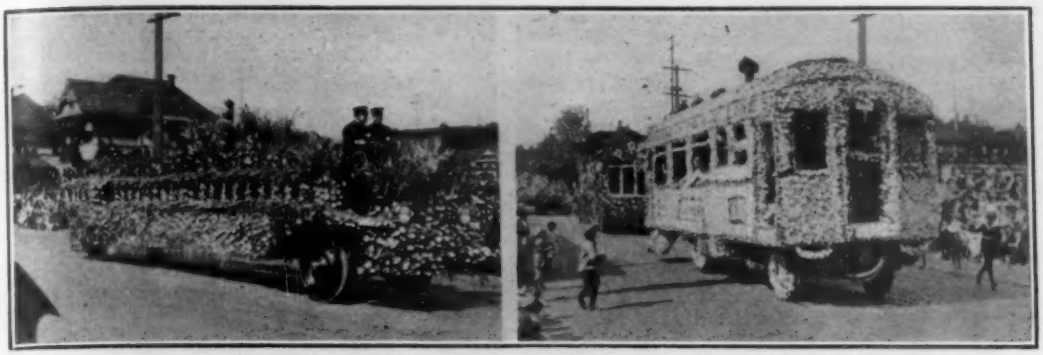
Construction Work by Municipal Forces in a Town of Less Than 5,000 Population

SALEM, VA.—While a great deal has been written both pro and con on the question of municipalities' undertaking construction work with day labor rather than by contract, most of these discussions have dealt with the matter from the point of view of cities of over 20,000 population. The following brief account of the way in which the town of Salem, with a population of less than 5,000, is successfully handling its construction work with municipal forces may therefore be of interest to some readers of THE AMERICAN CITY.

When this plan was first adopted in Salem a few years ago, the Town Manager added to his other duties that of superintending the construction work; it was found that the office force could handle the additional clerical work without extra help and, for the field work, the addition of a construction foreman was all that was necessary. As soon as a permanent improvement program is completed, the foreman is transferred to other jobs, wherever he can fit in. For example, in the first year in which the work was handled in this way, the permanent improvements were completed in four months' time. The foreman was then put on a fire inspection job that lasted about two months, during which time each house in the town was inspected for possible fire hazards. Following this, he filled a temporary vacancy in the police force. As to the force of laborers, the best men are kept busy on maintenance work during the winter until the construction work is renewed. In this connection it has been interesting to note the new enthusiasm among the men which comes as a result of their relief from the monotony of handling only maintenance work.

As the small municipality usually has but a limited amount of its current revenue to expend for permanent improvements, the savings that can be effected through doing the work by municipal forces are worthy of consideration. As a rule, the municipality can purchase materials at much lower rates than can contractors. In the case of Salem, the town operates its own stone quarry, and stone is crushed for considerably less than the current market price. In the matter of equipment, we have found that that which we have on hand for maintenance work is practically sufficient to take care of the new work as well. Thus the expense of moving a contractor's equipment and forces to the town, an item which would have to be included in a contract price, is eliminated. Finally the amount of the contractor's bond and profit is saved.

For the first two years in which the permanent improvements were handled by municipal forces, this town had an annual appropriation of about



FLOATS ENTERED IN PORTLAND'S FLORAL PARADE BY A FIRE COMPANY AND A RAILROAD COMPANY
No artificial flowers are allowed for decoration. Note the vast number of blossoms used on these two floats

$20,000 for this purpose. At the end of the second year, a bond issue was submitted to the voters with the distinct understanding that the work would be done by town forces. From the fact that the issue carried by a majority of almost three to one, it is evident that the citizens of Salem endorse their town's policy along this line.

J. P. BROOME,
Town Manager.

Portland's Civic Playtime— Rose Festival Week

PORTLAND, ORE.—The citizens of the "rose capital of the United States," appreciating their bounty of blossoms, each June designate a period of celebration in honor of "the queen of all the fragrances." Then this city becomes the monarchy "Rosaria," ruled by queen instead of mayor. A holiday is declared; business and politics are ignored. Hotels fill with tourists and nearly every home has out-of-town guests.

For almost twenty years Portland has held her Rose Festival, and each year it grows more elaborate. The Royal Rosarians are working on its details throughout the year, that the civic fiesta may be worthy of its national reputation.

Roses in this western city grow as luxuriantly as clover. The humblest cottage and the mansion alike have their rose bowers. The streets are bordered with rose-beds, laid out by the city and individuals. In Washington Park are the famous rose test gardens. In spite of the myriads of blossoms used in the celebration, apparently there are just as many remaining in gardens!

Ceremonials, pageants, balls, rose shows, regattas and processions mark the Festival, and throughout a true spirit of democracy reigns. Rich and poor share in the events and are among the spectators.

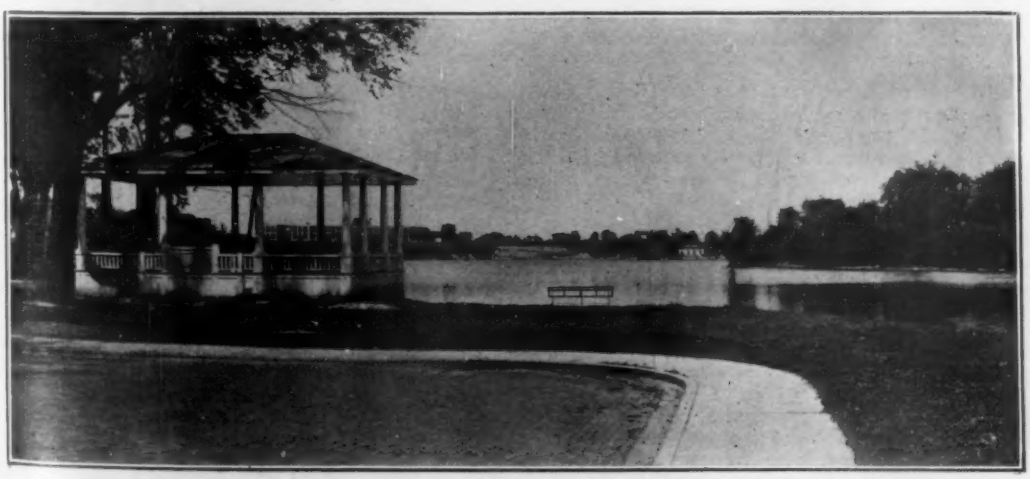
The floral parade is the prime event. Portland and its guests turn out en masse to view the marching organizations and the hundreds of decorated floats. Many out-of-town entries compete for prizes, and civic groups vie with one another.

It is a city's holiday!

MARGUERITE NORRIS DAVIS.

Lake-Front Improvements and Municipal Parking Space

SENECA FALLS, N. Y.—In the record of accomplishments to the credit of this village for last year are included two improvements of which the people of the community are particularly proud. One of these is the erection of a handsome band-stand on the shore of Lake Van Cleef. This was presented to the village by Mynderse Van Cleef, a resident of Ithaca, N. Y., as a memorial to his uncle, Lawrence Van Cleef, the first white child born in Seneca Falls. The gift was made at the sugges-



BAND-STAND ON THE LAKE-FRONT AT SENECA FALLS, N. Y

tion of the Seneca Falls Business Men's Association. The grounds surrounding the band-stand, which were enlarged by filling in part of the lake-front, have been laid out with shrubbery and flowers, so that a very attractive small park has been created.

The second improvement referred to is the transformation of an unsightly piece of ground into an automobile parking space. In the rear of the retail stores on the south side of Fall Street, the principal business thoroughfare of the village, there extends a plot of made ground, 75 feet in width, bordering on the barge canal. On this tract, a strip 40 feet wide is reserved by the state as a driveway and space for the loading and unloading of boats, and the remainder was formerly made a dumping ground for ashes and refuse of all kinds. This 35-foot strip was taken over by the village authorities last year, and it has since been put in shape for use as an additional parking space during the busy tourist season. The ground has been leveled off, a fence extending for about 600 feet has been erected to prevent cars from being driven too close to the water; and electric flood-lights, placed 100 feet apart, have been installed to insure safe driving at night. By reserving the center of the plot for parking, about 100 cars, ranked side by side, can be taken care of at one time, with space for a driveway on either side.

A. S. HUGHES,
Village President.

A TYPICAL BILOXI FIRE-STATION, SHOWING PUMPER NO. 1 AND HOOK AND LADDER NO. 1

EAST BEACH BOULEVARD, BILOXI
One of the newly paved streets which enable firemen to make quick runs

Reasons for Biloxi's Low Fire Loss

BILOXI, MISS.—With the total fire loss for Biloxi during the last three years amounting to not more than $25,000, this city feels that it has reason to be proud of its Fire Department, to whose efficiency this splendid record is largely attributable. In spite of the fact that 101 alarms were answered last year—the greatest number for any year in the history of the city—the year's loss from fire reached only $13,500. Nearly one-half of that amount is accounted for by the destruction of one home, and in this particular instance we believe the loss would have been appreciably less had the alarm been turned in more promptly.

The motorization of Biloxi's five fire-stations was completed in 1918. The horse-drawn chemical wagons in the East End and West End stations were converted into combination hose-and-chemical wagons and placed on Studebaker chassis; the hook-and-ladder truck was remounted on a White chassis, and the two hose wagons were mounted on Oldsmobile chassis. A considerable sum of money was saved by this method of transformation, and the work was so well done that the present apparatus shows no sign of its having been formerly horse-drawn. Over a year ago a 750-gallon America-LaFrance pumper was added to the equipment of one of the stations, and a runabout car has been provided for Chief Barthes, who for nearly twenty years has been at the head of the Department. All the engines, with the exception of the pumper, are on pneumatic tires. Three of the stations were rebuilt last year and are now of the bungalow type.

Alarm districts have been created and the stations are so arranged that at least one piece of apparatus can be at the scene of any fire within the city not later than two minutes after the alarm is received. When a blaze is reported in the business district or in the central beach section, the alarm automatically becomes a general one which summons all apparatus to the scene.

One important reason for this city's low fire loss is found in the fact that there is a never-failing water-supply from deep artesian wells at the command of the Department. When an alarm is received, powerful electric pumps are put into operation. Should the electric wires go dead during a fire, a large steam pump is ready for

use, and should both these devices fail, the American-LaFrance pumper, which can be used to draw water from the Gulf and bays as well as from the hydrants, may be put into service.

The Department, which was founded forty-two years ago with volunteer companies, is now operating on a combination paid and volunteer basis. While all of the apparatus is now handled by paid firemen, the valuable assistance of volunteer members is still depended upon, and until the city is in a position to carry a force of paid men sufficient to insure the safety of the community, the volunteer bodies will be welcomed and continued at each station.

ANTHONY V. RAGUSIN,
Secretary, Biloxi Chamber of Commerce.

Making Public Health Popular

PROBABLY the most popular issue ever published of *Chicago's Health* will prove to be that of March 10, which Dr. Herman N. Bundensen has devoted to "Crossworditis." It is evident that Chicago's Commissioner of Health regards this national affection as a very salutary disease, meriting encouragement by the Health Department. An effective feature of the bulletin is the section headed:

WE LIVE A CROSS-WORD PUZZLE

"All life is a cross-word puzzle. In the cross-word puzzle one word gives the key to other words, and if properly guessed makes the puzzle more easy of solution.

"In life each of us fits in a certain place or niche. We cannot live alone. We are gregarious. Our lives are keys to other lives. Our acts are definitions of our lives that have an effect upon the community. We depend upon others, and others depend upon us! If our lives and our acts are well keyed, all comes out well; if not, the end is wrong, which in life means illness, misspent time, unhappiness, or perhaps untimely death.

MAGNIFYING OUR WORRIES

THE SEARCH FOR HEALTH

"Health is dependent upon properly keyed acts. A wrong or improper act in matters of health sets up a wrong series of reactions and leads to preventable illness and disaster.

"On the other hand, due concern for one's health brings consideration for the health of neighbors and the rest of the community. There necessarily follows, in the same keyed order as the cross-word puzzle, the proper spirit and action that quickly and successfully solve the problem of hygiene and sanitation, bringing happiness and longer life to the individual, and prosperity to the community."

Another issue of *Chicago's Health*, that of March 17, covers a subject often neglected in public health campaigns. This issue has for its theme, "What's the Use of Worrying?" Several cartoons poke fun at the worrier, while the serious discussion covers such phases of the subject as: "Only Humans Worry," "The Character of a Worrier," "Idleness a Cause of Worry," "Why Some Worry," "The Effects of Worry on the Body," and "How to Avoid Worry."

Libraries and Adult Education

ADULT education service has recently been inaugurated by a number of libraries, according to information received by the Adult Education Commission of the American Library Association. Adult education service gives systematic, individualized assistance to young people out of school and to others who wish to study independently and who need advice about books even before they need the books themselves.

The Indianapolis Public Library now has in operation its Readers' Adviser Service, Out-of School Division. Two librarians with desks near the entrance are in charge, and they have outlined some seventy-five reading courses for almost as many individuals. Favorite courses are on short-story writing and journalism.

The Omaha Public Library now advertises the services of a readers' assistant. A Readers' Bureau has recently been inaugurated in the Cincinnati Public Library. The Minneapolis Public Library is developing plans for an adult education service. The Oshkosh, Wis., Public Library has carefully made plans for adult education work beginning with a study of community needs.

Boston's New Police and Traffic Squad Station

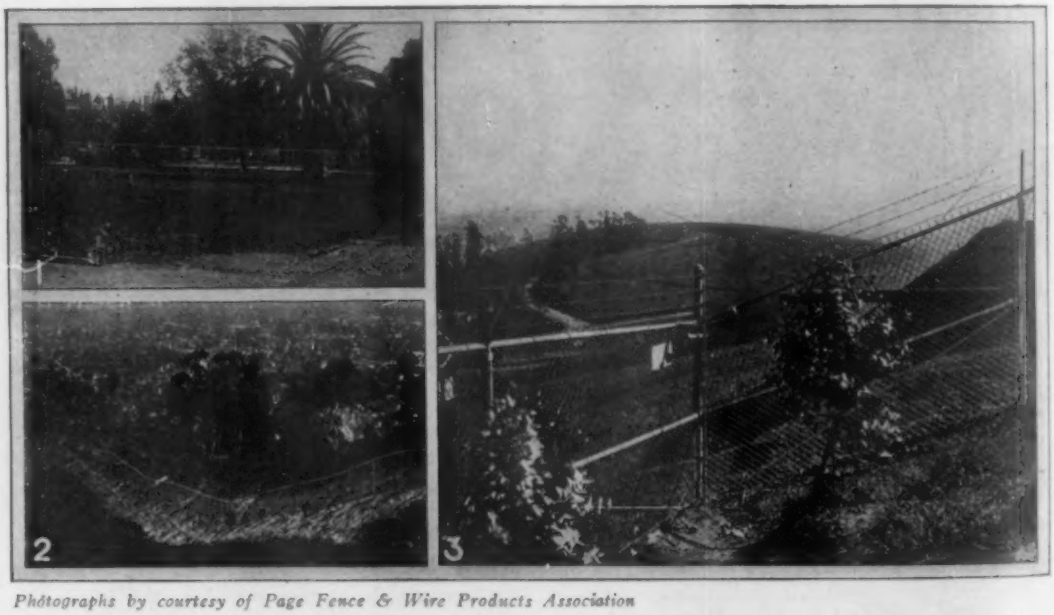
WHAT is said to be the largest police station in the world has been erected for the city of Boston. The dedication of this new building, which will house the men of Division 2 and the traffic squad, took place recently, with prominent city officials and citizens taking part in the exercises.

The building is a ten-story structure with basement, has a floor area covering 60,000 square feet of space, and has been erected at a total cost, inclusive of the land, amounting to approximately $650,000. It is of steel construction with brick walls and granite trimmings, reinforced concrete floors and roof, and terra-cotta partitions.

The first four floors are occupied by the Division 2 police, with guard room, booking office, cell room with fifteen cells, emergency room, signal room, and a four-car garage on the first floor. The second, third and fourth floors contain bedrooms and necessary accommodations for eight superior officers and sixty officers or patrolmen. The fifth and sixth floors are occupied by the Traffic Division, with accommodations for two hundred men, including shower-baths, lockers, and a guard room. The seventh, eighth and ninth floors house the property clerk's department, with cold-storage plant for uniforms, tailor shops, stock-rooms, lost-article rooms, and vault. A drill hall occupies the entire tenth floor.

The building also contains private offices for the heads of departments, kitchens, and toilet rooms, and has a private fire-alarm system, inter-communicating telephones, and loud speakers for the guard rooms.

A Novel Use for the Top Rail of a Fence



Photographs by courtesy of Page Fence & Wire Products Association

THE TOP RAIL OF THIS PROTECTION FENCE AROUND FOREST LAWN MEMORIAL PARK, GLENDALE, CALIF., IS USED AS A PIPE TO CONDUCT WATER FOR SPRINKLING LAWNS AND FLOWERS IN THE CEMETERY

Figs. 1 and 2 show two views of the park. Fig. 3 shows the corner construction

Water-Supply Statistics for Municipalities of Less Than 5,000 Population—IV

Statistics from 3,700 Cities Compiled for Publication in THE AMERICAN CITY and the 1925 Municipal Index—The Following Explanatory Material Is Reprinted from Our February Issue

THROUGH the cooperation of municipal water-works officials and the officers of water companies, THE AMERICAN CITY MAGAZINE is able to offer to its readers and to recipients of the 1925 Municipal Index the largest compilation of water-supply statistics that has yet been published. In order to facilitate the distribution of these statistics, all the data for cities of over 5,000 population are being published in the 1925 Municipal Index, and for cities of less than 5,000 population in THE AMERICAN CITY MAGAZINE serially, beginning with February, 1925.

The tables, in which the cities are arranged alphabetically by states, show whether the water-works are owned by the municipality or by a private company. The source of supply is recorded merely as underground or surface, the former including shallow wells, deep wells, artesian wells, flowing springs, and mountain springs, and the second such sources as rivers, lakes, ponds, canals, and creeks.

The distance of the source from the city is an important matter from the fire protection standpoint as well as from the standpoint of comparison when it comes to capital investment. Storage facilities are described under three heads, namely, reservoirs, stand-pipes, and elevated tanks.

Filtration systems are divided into mechanical or American systems, slow sand filtration or the older type of filtration, and pressure filters, as applied to the mechanical filtration. In examining the entire set of reports, only chlorine and hypochlorite show as American sterilization practice to-day, with liquid chlorine by far the most common method.

In order that some idea of the total investment in pumps may be reached, the total pump capacity in million gallons daily is recorded. In some instances where low-lift pumps are used to move water from a river to a filtration plant and then high-lift pumps are used to force the filtered water through the distribution system, the total pump capacities may give an erroneous idea as to the capacity of the system. Lack of space, however, made it impossible to differentiate in these cases, as the pump capacity is recorded chiefly to show the investment in this element of the plant.

American cities are noteworthy for their excessive consumption of water. Even communities where industrial uses are not great have consumptions of 500, and some even as high as 1,000 gallons per capita. As far as possible, in these statistics domestic services are differentiated from those supplying stores, factories and industries.

Statistics are given for the number of hydrants in each city and whether they are owned by the municipality, or by the water company. The average rental per hydrant per year is given in those cases where a hydrant is charged to the water company or is credited to the account of a water department. In many cases water companies charge no hydrant rental, as such service is required in their franchise. Unfortunately, in only a few cases are water departments credited with the maintenance of the hydrants.

The average pressures for water-supplies, as well as the increased pressures for fire service, are given, as this has some bearing on the general type of pipe in use.

The following symbols are used throughout these tables to make it possible to give a greater amount of information in small space:

A —American type, rapid or mechanical filter
B —Brass pipe
C —Concrete pipe
Ch —Sterilization by liquid chlorine
Cl —Cement-lined pipe
Co —Copper pipe
F —Pressure filter
G —Galvanized iron pipe
H —Consumer or householder
Hy—Sterilization by hypochlorite
I —Cast iron pipe
K —Kalamein pipe (also Calamein and Calamine)
L —Lead pipe
Ll —Lead-lined pipe
M —Municipally owned
O —Slow sand filter
P —Owned by private company
Pp —Stand-pipe
R —Storage or distribution reservoir
Ri —Rolled iron pipe
Tc —Terra cotta pipe
Rv —Riveted pipe
S —Surface source of water-supply
So —Water softener
St —Steel pipe
T —Elevated tank
Tl —Tin-lined pipe
U —Underground source of water-supply
V —Vitrified pipe
W —Wood pipe
Wr—Wrought iron pipe

Municipality Ownership of Water works	Population	Source		Storage	Filters	Sterilized	Distribution System			Pipe Sizes Inches		Pump Capacity m. g. d.	Main Supply Metered
		Type	Aver. Miles from City				Total Miles of Main	Kind of Pipe		Mains	Services		
								Mains	Services				
Missouri (con.)													
Marceline.....M	3,760	S	1.5	RPp	No	.....	2.0	I	.....	12	4	.....	No
Marionville.....P	1,400	U	1.0	RPp	No	No	2.8	I	G	2–6	¾	1.4	Yes
Memphis.....M	1,985	S	0.8	T	No	.....	8.0	I	L	4–8	.....	0.6	No
Milan.....M	2,395	S	1.0	Pp	A	Ch	7.3	I	L	2–8	¾	0.7	No
Monroe.....M	1,949	S	1.0	Pp	A	Hy	5.0	I	L	4–10	¾	0.5	No
Montgomery City.....M	2,000	U	18.0	PpT	No	No	3.0	I	Wr	4–6	.....	0.07	Yes
Mountain Grove.....M	2,500	U	0.1	Pp	No	No	5.0	I	I	2–8	¾	.....	No
New Franklin.....M	1,000	U	0.0	Pp	.....	.....	1.5	I	G	4–6	.....	0.1	No
Odessa.....M	1,850	S	2.5	RT	A	Ch	12.0	I	Wr	2–8	¾–2	0.6	Yes
Oronogo.....M	.....	U	0.5	RPp	No	.....	4.0	.....	Wr	4–8	.....	0.1	No
Pacific.....M	1,418	U	0.5	R	No	.....	4.0	IW	.....	4–8	¾	0.3	No
Palmyra.....M	2,168	SU	2.0	RT	A	Ch	9.0	I	G	4–10	.....	1.0	No
Paris.....M	1,474	S	0.8	Pp	A	Ch	5.5	I	G	2–8	½–2	0.2	Yes
Pierce City.....M	2,043	U	0.3	Pp	.....	Ch	5.5	I	LI	4–8	.....	1.0	No
Plattsburg.....M	2,000	S	1.0	RPp	A	Ch	8.0	I	I	2–8	¾	0.4	No
Princeton.....M	1,385	U	0.5	Pp	No	No	3.0	.....	.....	4–8	.....	0.8	No
Richmond.....M	4,800	U	2.5	RPp	A	No	10.0	.....	G	4–10	.....	1.0	Yes
Ste. Genevieve.....P	2,500	U	0.5	T	.....	...	3.0	I	G	4–8	¾	.....	No
Slater.....M	3,797	S	8.0	RPp	A	Ch	18.0	I	L	4–8	.....	2.0	...
Spickard.....M	800	S	0.3	Pp	No	.....	1.5	I	G	4–6	.....	0.4	No
Thayer.....M	3,157	U	0.3	R	No	No	15.0	I	IG	4	1½	2.0	No
Unionville.....M	2,000	S	1.5	R	O	Ch	6.0	I St	.....	3–8	.....	.....	No
Weston.....M	1,200	U	0.2	R	No	.....	10.0	I	.....	4–6	.....	0.4	No
West Plains.....M	3,178	U	0.3	RPp	No	No	5.3	I	G	4–8	¾–2	0.6	...
Willow Springs.....M	3,213	U	0.3	Pp	.....	No	6.0	.....	G	½–4	.....	0.05	No
Montana													
Belt.....M	1,000	U	0.8	R	No	No	0.7	I	G	2½–8	½–¾	.....	No
Big Timber.....M	1,456	S	6.0	R	No	No	12.0	W	.....	4–12	.....	0.4	No
Choteau.....M	1,100	U	0.5	R	No	No	5.0	St	G	6–10	½–2	2.3	No
Columbia Falls.....P	2,162	U	3.0	.....	No	No	10.0	W	W	8	.....	None	No
Columbus.....M	900	S	0.0	R	O	No	7.0	IW	GL	2–8	¾–2	0.4	Yes
Cut Bank.....M	1,200	S	1.0	R	No	No	.....	.....	.....	.....	.....	.....	No
Deer Lodge.....P	3,780	SU	4.0	R	A	No	14.5	IWKG	G	3–12	¾–1	None	No
Dillon.....M	2,701	S	8.0	R	No	No	17.0	IW	G	5–10	.....	.....	No
Eureka.....M	1,318	....	1.5	RPp	.....	.....	3.5	W	W	4–10	.....	.....	No
Glendive.....M	3,816	S	0.2	R	A	No	11.0	I	.....	2–10	¾–4	3.6	No
Hamilton.....P	1,800	S	7.0	R	No	Ch	16.5	.....	G	4–10	¾–2	.....	No
Harlowton.....M	2,387	U	1.0	R	No	No	9.0	IW	G	8	3¼	.....	No
Laurel.....M	2,300	S	1.5	PpT	No	Ch	10.0	IWSt	.....	4–12	¾	.....	No
Libby.....P	2,271	S	3.0	R	No	No	7.0	K	G	2–10	1½–¾	None	...
Philipsburg.....M	2,078	S	6.0	R	No	No	5.5	GW	.....	4–6	.....	.....	...
Polson.....M	1,500	S	6.0	RPpT	No	No	13.1	IW	WI	4–12	1–2	.....	No
Red Lodge.....M	4,515	S	2.0	.....	No	No	11.5	I	G	4–10	½–¾	None	No
Scobey.....M	1,400	U	2.0	RT	O	No	4.0	I	G	.....	¾	.....	Yes
Sidney.....M	1,200	U	0.5	PpT	No	No	2.5	I	.....	4–8	⅝–¾	1.4	No
Wolf Point.....M	2,225	U	0.0	T	No	No	3.9	I	G	4–8	¾	0.5	Yes
Nebraska													
Albion.....M	2,200	U	0.1	T	No	No	6.5	I	LG	4–6	¾	0.9	No
Alliance.....M	4,591	U	0.3	RPp	.....	.....	11.0	I	GL	4–10	.....	1.4	...
Alma.....M	1,498	U	0.5	T	No	No	7.0	St	G	2–8	1¼	0.3	No
Ashland.....M	1,910	U	....	R	.....	.....	4.1	.....	LI	4–8	.....	0.3	Yes
Atkinson.....M	1,820	U	....	Pp	.....	.....	2.5	I	G	4–6	.....	0.5	...
Aurora.....M	2,962	U	0.1	RPp	No	No	6.0	I Wr	Wr	2–10	.....	0.7	Yes
Bancroft.....M	742	U	0.0	RT	No	No	1.5	I	G	4–8	.....	0.4	No
Blair.....M	2,702	U	4.0	.....	.....	.....	1.5	I	Wr	4–8	½–2	2.3	No
Bloomfield.....M	1,264	U	....	RPp	No	No	6.0	I	G	2–8	.....	0.7	No
Blue Springs.....M	750	U	0.8	Pp	.....	.....	3.0	I St	G	2–12	¾–2	0.1	Yes
Bridgeport.....M	1,500	U	0.1	T	No	No	4.5	I	GL	4–8	¾–1½	0.6	Yes
Burwell.....M	1,350	U	0.0	T	No	No	4.3	I St	G	1½–6	¾	0.8	No
Cambridge.....M	1,500	U	0.5	Pp	No	No	....	I	G	1¼–8	¾	.....	No
Cedar Bluffs.....M	500	U	0.0	T	No	No	2.5	I	G	4–6	¾–1	0.3	No
Cedar Rapids.....M	749	U	0.5	R	No	No	2.27	.....	G	4–8	.....	0.4	No
Chappell.....M	1,200	U	....	T	No	No	10.0	I	.....	4–6	¾	.....	No
Clarks.....M	1,457	U	1.0	Pp	No	No	1.0	I	G	4	4	.....	No
Clay Center.....M	1,065	U	....	RPp	No	No	6.0	I Wr	IG Wr	2–8	.....	0.5	No
College View.....M	3,000	U	0.3	RT	No	No	3.0	IG	G	2–8	¾–2	0.8	No
Crawford.....M	2,530	S	7.0	R	O	No	15.0	IW	G	4–20	¾–2	0.2	No
Creighton.....M	1,600	U	0.5	Pp	.....	.....	5.0	I	G	4–10	.....	0.6	No
Crete.....M	2,245	U	0.5	R	.....	.....	9.0	I	GL	4–10	.....	1.0	Yes
Curtis.....M	1,017	U	....	R	No	No	....	.....	G	4–6	¾	0.2	No
Decatur.....M	1,000	....	0.3	R	No	No	2.5	I	G	4–6	¾	0.3	No
De Witt.....M	800	U	0.3	T	.....	.....	3.0	I	.....	4–8	.....	.....	...
Doniphan.....M	1,114	U	1.0	T	No	No	3.0	.....	L	2–6	⅝	0.4	No
Edgar.....M	996	U	0.0	RPp	A	No	1.5	I	G	4–10	.....	0.8	No
Elm Creek.....M	800	U	0.2	T	.....	No	1.8	I	G	4–6	¾	0.2	No

Consumption		Number of Services		Number of Meters		Per Cent Metered		Meter Rates per 1,000 Gallons		Meter Owned by	Hydrants			Average Pressure lbs per sq. in.	
Average Daily in 1,000 gals.	Per Capita	Domestic	Industrial	Domestic	Industrial	Domestic	Industrial	Max. Dom.	Min. Ind.		Number	Owned by	Aver. Rental each per year	Domestic	Fire
400	106	400	15	.....	10	.....	67	15¢	8¢	M	35	M	$25	.....	.....
55	39	450	.....	450	.....	100	.....	35¢	35¢	P	12	P	$50	45	100
35	18	135	2	.....	.....	.....	.....	50¢	10¢	M	53	M	None	40	40
250	105	184	2	184	2	100	100	50¢	10¢	H	47	M	None	70	95
90	46	450	3	450	3	100	100	35¢	15¢	H	61	M	.....	80	150
30	15	140	3	140	3	100	100	75¢	50¢	H	35	M	.....	45	45
40	16	200	30	200	30	100	100	.....	.....	M	48	M	None	60	80
30	30	110	.....	95	.....	86	.....	15¢	15¢	H	15	M	.....	45	45
50	27	200	10	200	10	100	100	30¢	20¢	M	56	M	$40	70	70
120	.....	200	.....	20	1	10	.....	40¢	40¢	.....	12	M	.....	65	65
40	28	160	.....	140	.....	88	.....	50¢	.....	M	23	M	.....	80	80
100	46	300	.....	100	.....	33	.....	35¢	10¢	M	50	M	None	60	200
100	68	324	.....	324	.....	100	100	40¢	20¢	MH	27	M	.....	47	88
75	37	225	.....	52	.....	23	.....	.....	.....	H	32	M	.....	63	70
30	15	216	.....	216	.....	100	.....	60¢	35¢	M	38	M	.....	50	.....
80	58	100	.....	10	.....	10	.....	40¢	.....	H	24	M	.....	30	70
180	38	970	6	970	6	100	100	50¢	30¢	H	84	M	None	60	80
30	12	125	.....	125	.....	100	100	38¢	38¢	P	41	P	$50	40	65
85	22	250	.....	250	.....	100	.....	$1	35¢	H	69	M	.....	40	160
5	6	70	5	0	0	0	0	.....	.....	.....	14	M	$6	38	50
20	6	146	10	40	10	27	100	50¢	50¢	H	38	M	None	50	85
15	8	250	.....	200	.....	80	.....	50¢	50¢	M	30	M	.....	60	110
.....	.....	.....	.....	.....	.....	.....	.....	25¢	19¢	H	25	M	.....	85	105
175	55	551	.....	551	.....	100	.....	50¢	10¢	H	38	M	$10	75	100
.....	.....	225	.....	40	.....	18	.....	35¢	20¢	M	7	M	.....	30	50
100	100	225	20	6	20	3	100	30¢	15¢	M	29	M	$12	120	120
.....	.....	375	None	None	None	.....	.....	.....	.....	.....	34	M	$36	50	75
150	136	192	6	4	6	2	100	23¢	5¢	H	40	M	None	65	115
.....	.....	129	19	.....	9	.....	47	.....	60¢	H	28	P	$60	40	.....
.....	.....	183	46	167	41	91	89	.....	.....	M	30	M	None	88	88
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50	80
1,000	266	642	46	.....	6	.....	1	.....	8¢	P	32	P	$54	83	83
300	111	648	2	459	2	71	100	63¢	20¢	M	49	M	None	80	80
.....	.....	200	.....	None	None	.....	.....	.....	.....	.....	25	M	None	90	90
350	92	850	1	804	1	95	100	80¢	5.8¢	M	80	M	$24	70	100
1,250	700	367	86	None	76	.....	88	.....	7¢	P	62	P	$30	50	50
188	79	315	3	61	3	20	100	75¢	30¢	M	15	M	None	50	50
500	218	500	3	250	3	50	100	.....	.....	.....	46	M	None	86	86
.....	.....	400	.....	.....	.....	.....	.....	.....	.....	.....	21	P	$60	80	80
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	26	M	None	.....	152
.....	.....	325	133	20	3	6	2	.....	.....	M	53	M	$33	65	65
.....	.....	800	5	None	None	.....	.....	.....	.....	.....	55	M	None	120	120
30	21	45	31	45	31	100	100	$1	15¢	M	39	M	None	63	63
34	28	156	.....	148	.....	95	.....	15¢	10¢	M	31	M	$12	48	120
80	36	266	.....	133	.....	50	.....	.....	67¢	M	36	M	$60	52	52
320	145	500	2	500	2	100	100	25¢	25¢	H	55	M	.....	60	60
100	22	850	.....	850	.....	100	.....	.....	.....	.....	90	.....	.....	42	.....
424	283	200	.....	200	.....	100	.....	20¢	.....	M	60	M	.....	55	55
54	28	200	.....	40	.....	20	.....	35¢	15¢	H	27	.....	.....	55	100
40	22	198	.....	198	.....	100	.....	20¢	.....	H	20	M	.....	65	100
180	61	900	.....	900	.....	100	.....	$1.25	15¢	H	46	M	.....	37	90
20	27	206	.....	86	.....	42	.....	50¢	.....	H	14	M	.....	56	108
.....	.....	421	.....	385	.....	92	.....	.....	.....	M	46	.....	.....	100	100
62	49	400	.....	375	.....	94	.....	35¢	35¢	H	35	M	None	68	75
20	27	170	3	100	3	59	100	35¢	30¢	M	22	M	None	35	80
51	34	228	.....	228	.....	100	.....	20¢	12¢	H	54	M	None	60	60
40	30	215	42	215	42	100	100	30¢	30¢	H	33	M	.....	35	43
60	40	300	38	300	38	100	100	20¢	20¢	H	64	M	.....	45	45
25	50	145	.....	145	.....	100	.....	30¢	.....	H	24	M	$4	55	83
50	67	220	.....	210	.....	96	.....	25¢	.....	H	26	M	.....	45	90
.....	.....	261	.....	261	.....	100	.....	15¢	15¢	MH	25	M	None	40	40
15	10	68	.....	.....	.....	.....	.....	.....	.....	.....	20	M	.....	60	60
140	132	250	4	250	4	100	100	27¢	7¢	H	42	M	.....	45	130
135	45	570	.....	570	.....	100	.....	20¢	17½¢	H	60	M	None	62	65
800	316	400	8	400	8	100	100	12¢	7¢	M	42	M	.....	85	75
35	22	275	.....	275	.....	100	.....	33¢	.....	H	54	M	.....	45	45
209	89	450	600	450	.....	1 0	.....	20¢	10¢	H	62	M	None	60	93
100	99	200	.. ...	200	.... .	1(	. ...	20¢	15¢	H	35	M	None	50	50
.....	.....	140	....	140	.....	100	.....	24¢	27¢	H	17	M	.....	86	86
.....	.....	60	20	60	20	100	100	50¢	15¢	M	38	M	.....	.....	55
.....	.....	120	.....	120	.....	100	.....	20¢	.....	M	30	M	None	55	100
36	137	240	.....	240	.....	100	.....	25¢	25¢	H	46	M	None	50	50
18	23	104	.....	103	.....	100	.....	20¢	.....	H	17	M	.....	46	46

Municipality Ownership of Water works	Population	Source		Storage	Filters	Sterilized	Distribution System			Pipe Sizes Inches		Pump Capacity m. g. d.	Main Supply Metered
		Type	Aver. Miles from City				Total Miles of Main	Kind of Pipe: Mains	Kind of Pipe: Services	Mains	Services		
NEBRASKA (con.)													
Fairfield.....M	1,054	U	0.0	T	No	No	5.0	I	G	4-8	¾	.....	No
Geneva.....M	2,000	U	0.0	Pp	.....	.....	2.5	I	GL	2-8	.....	0.2	Yes
Genoa.....M	1,472	U	....	Pp	.....	.....	2.0	.....	G	4-10	.....	.....	No
Gothenburg.....M	.....	U	1.0	T	No	No	7.0	I	I	4-6	.....	0.2	No
Harvard.....M	1,200	U	0.1	RPp	No	No	3.0	I	L	4-9	⅝	0.5	No
Havelock.....M	3,602	U	0.0	RT	.....	.....	10.0	I	GL	4-8	.....	.....	Yes
Hay Springs.....M	1,169	U	0.0	R	No	No	0.8	I	G	4-6	.....	0.12	Yes
Holdrege.....M	3,108	U	0.1	Pp	No	No	7.0	I	L	4-12	.....	0.6	No
Howells.....M	1,000	U	1.0	Pp	No	No	2.2	I	G	4-6	1½-2	0.1	No
Lexington.....M	2,327	U	0.1	Pp	.....	.....	6.0	.....	.....	2-10	⅝-1¼	1.0	...
Long Pine.....M	1,200	U	2.0	Pp	.....	.....	3.0	.....	.....	2-6	.....	0.5	...
Loup City.....M	1,328	U	0.1	R	No	No	6.5	I	G	3-6	¾-1	0.2	Yes
Lynch.....M	592	U	0.5	R	No	.....	2.5	I	G	4-6	1½-2	0.3	No
Lyons.....M	1,025	U	0.0	T	No	No	2.0	I	L	4-8	¾	0.1	No
Madison.....M	1,735	U	0.08	Pp	No	No	5.0	I	I	2-8	¾	0.9	No
Mitchell.....M	.....	U	0.0	T	No	No	....	.....	G	4-10	¾	0.2	Yes
Neligh.....M	2,000	U	0.08	Pp	No	.....	6.75	I	G	4-6	.....	0.9	No
Newcastle.....M	500	U	0.0	R	No	No	4.0	.....	G	4-6	¾-1¼	0.1	No
North Bend.....M	1,100	U	0.05	Pp	No	No	2.5	I	G	4-6	¾	1.0	No
Ord.....M	2,143	U	0.5	R	.....	.....	4.25	I	Wr	4-8	.....	.....	No
Orleans.....M	1,000	U	0.5	Pp	No	No	4.0	I	G	4-8	¾	0.2	No
Osceola.....M	1,500	U	0.0	Pp	No	No	5.0	I St	G	4-8	.....	0.6	No
Pawnee City.....M	2,000	U	0.5	RPp	No	Ch	8.0	I	IL	4-10	¾-2	1.2	Yes
Pender.....M	1,000	U	0.0	Pp	No	.....	2.5	I	G	2-10	⅝	0.8	No
Pierce.....M	1,750	U	0.0	T	No	No	3.0	I	G	4-10	.....	0.1	Yes
Plainview.....M	1,300	U	....	T	No	No	3.0	IG	G	1¼-6	¾-2	.....	...
Ravenna.....M	2,140	....	0.08	R	.....	.....	9.5	I	L	4-8	1½-2	1.1	Yes
Red Cloud.....M	2,464	U	0.5	RPp	No	Ch	5.0	I	G	4-8	¾	1.0	No
Schuyler.....M	2,636	U	0.25	Pp	No	No	8.0	IW	GL	4-12	¾-4	1.3	Yes
Scribner.....M	1,042	U	....	T	No	No	2.0	IW	G	4-8	¾	0.1	No
Seward.....M	2,450	U	4.0	RPp	No	No	12.5	I	GL	3-10	¾-10	0.75	Yes
Sidney.....M	2,852	U	0.08	Pp	No	No	10.0	I	G	4-16	⅝	1.0	No
Stanton.....M	1,342	....	...	Pp	.....	.....	5.0	I	I	4-8	.....	.....	No
Superior.....M	2,719	U	1.0	R	.....	Ch	15.0	I	G	4-10	.....	1.3	No
Tecumseh.....M	1,748	SU	0.25	RPp	A	Ch	5.5	W	G	4-10	.....	1.25	Yes
Tilden.....M	1,000	U	0.1	T	No	No	3.5	I	G	4-10	¾	0.74	No
Wahoo.....M	2,338	U	0.4	Pp	.....	.....	10.0	I	IG	4-12	.....	1.0	...
Wayne.....M	2,115	U	0.5	Pp	No	No	10.0	I	I	4-10	.....	0.1	No
West Point.....M	2,002	U	0.0	T	No	No	5.0	IK	G	4-8	¾	0.24	No
Wilbur.....M	1,901	U	0.1	Pp	.....	.....	3.5	I	.....	4-8	.....	0.93	No
Wood River.....M	1,408	U	0.05	T	O	No	2.0	I	I	2-6	¾	0.16	No
NEVADA													
Elko.....M	2,750	U	7.0	RPp	No	No	6.0	St	G	2-12	¾	0.5	No
Ely.....P	2,090	U	1.0	RPp	No	No	14.0	IW	G	6-16	.....	None	No
Fallon.....M	1,800	U	1.5	R	No	No	9.0	WG	G	¾-2	¾-2	1.5	No
Goldfield.....P	1,000	U	25.0	T	.....	.....	45.0	WSt	.....	4-9	.....	0.03	Yes
Las Vegas.....P	4,200	U	1.8	.....	O	No	5.25	W	G	6-12	¾	None	No
Tonopah.....P	4,144	U	15.0	RPp	.....	.....	13.5	.....	G	.....	.....	0.7	...
Virginia City.....P	1,200	S	38.0	R	.....	.....	20.0	.....	I	1-12	.....	.....	...
Winnemucca.....P	2,011	U	....	R	.....	.....	17.3	W	G	4-10	.....	0.4	...
Yerington.....M	1,200	U	0.3	T	No	No	4.6	W	G	4-8	¾-1½	0.8	No
NEW HAMPSHIRE													
Andover.....M	1,121	S	1.0	.....	.....	.....	3.0	.....	G	4-12	1½-2	.....	No
Antrim.....M	1,200	S	5.0	R	No	No	6.0	W	G	4-9	¾	.....	No
Ashland.....M	1,325	S	2.5	R	No	No	5.0	I	G	6-10	¾-1	None	No
Bartlett.....M	600	S	2.0	R	No	No	5.0	I	G	6-10	¾	.....	No
Belmont.....M	1,194	S	1.0	R	.....	Ch	4.0	W	G	.....	.....	0.3	No
Boscawen.....M	1,260	S	7.0	R	.....	.....	14.0	W	.....	4-12	.....	.....	...
Bristol.....P	1,428	S	2.8	.....	.....	.....	7.0	IWC	I	4-20	.....	.....	...
Colebrook.....P	1,811	S	2.0	R	.....	.....	10.0	IG	G	6-10	.....	.....	...
Epping.....M	1,600	S	0.1	T	No	Ch	1.5	St	St I	4	1-1¼	0.1	No
Farmington.....M	3,000	U	0.5	R	O	No	4.0	I	G	4-10	.....	0.1	Yes
Fitzwilliam.....M	1,148	U	....	R	No	No	0.5	L	.....	2	.....	.....	...
Goffstown.....M	2,391	S	1.5	R	.....	.....	5.0	I	G	4-12	.....	.....	No
Gorham.....M	2,734	S	4.0	R	No	No	15.0	I	G	4-12	.....	.....	...
Greenville.....M	1,364	U	1.0	R	.....	.....	5.0	I	G	2-6	¾-1	0.1	No
Hanover.....MP	2,264	S	2.5	R	.....	.....	12.5	I	B	4-14	¾	.....	...
Haverhill.....M	400	U	2.0	R	No	No	5.0	I	G	4-8	¾	.....	No
Henniker.....M	1,344	U	1.0	R	.....	.....	7.0	I	G	4-10	.....	0.03	...
Hillsboro.....M	2,300	S	4.0	R	No	No	8.0	IC	IC	4-16	¾	.....	No
Jaffrey.....M	2,303	S	3.5	R	No	No	9.5	I	G	4-12	¾-1	0.4	No
Lancaster.....M	3,000	S	6.0	R	.....	.....	12.0	I	G	6-12	1½-1¼	.....	...
Meredith.....M	1,680	SU	1.8	R	.....	.....	5.5	I	I	4-10	.....	0.6	No
Newport.....M	4,109	S	5.5	R	No	No	20.3	I	CI	4-12	1	.....	No
North Conway.....M	900	S	3.0	R	No	.....	14.0	I	G	2-6	¾-1	.....	...

Consumption		Number of Services		Number of Meters		Per Cent Metered		Meter Rates per 1,000 Gallons		Meters Owned by	Hydrants			Average Pressure lbs per sq. in.	
Average Daily in 1,000 gals.	Per Capita	Domestic	Industrial	Domestic	Industrial	Domestic	Industrial	Max. Dom.	Min. Ind.		Number	Owned by	Aver. Rental each per year	Domestic	Fire
.....	.....	225	.....	225	.....	100	.....	29¢	.....	H	50	M	.....	52	.....
120	82	250	.....	.....	.....	.....	.....	$2.70	13¢	H	40	M	.....	40	50
50	34	250	.....	250	.....	100	.....	20¢	.....	.....	17	M	.....	90	90
120	.....	None	.....	300	.....	.....	.....	15¢	.....	M	52	M	None	60	.....
32	27	290	4	280	4	96	100	25¢	25¢	M	46	M	None	50	55
215	60	850	2	845	2	99	100	25¢	20¢	H	110	M	.....	60	95
.....	.....	121	.....	121	.....	100	.....	30¢	.....	H	26	M	None	90	93
.....	.....	900	.....	900	.....	100	.....	.....	.....	M	78	M	.....	50	100
15	15	60	20	60	20	100	100	25¢	15¢	H	25	M	None	55	85
1,000	430	600	.....	600	.....	100	.....	15¢	15¢	M	75	M	.....	48	85
.....	.....	77	.....	.....	.....	.....	.....	.....	.....	.....	21	.....	.....	75	75
75	57	286	1	291	1	100	100	30¢	12¢	H	57	M	.....	43	45
50	84	118	.....	102	.....	86	.....	35¢	15¢	H	14	M	.....	65	65
60	59	325	2	170	2	52	100	50¢	20¢	M	22	M	.....	65	180
.....	.....	6	.....	6	.....	100	.....	50¢	.....	.....	40	M	None	70	100
300	.....	.....	.....	.....	.....	.....	.....	25¢	10¢	M	30	M	.....	45	45
108	54	406	.....	403	.....	99	.....	30¢	30¢	H	50	M	None	75	80
30	60	50	25	0	0	0	0	.....	.....	.....	20	M	$12	60	100
50	45	190	.....	175	.....	92	.....	25¢	.....	M	23	M	None	30	80
30	14	600	.....	600	.....	100	.....	50¢	15¢	H	45	.....	None	60	65
50	50	260	10	255	10	98	100	40¢	35¢	M	50	M	None	60	60
50	33	350	.....	350	.....	100	.....	30¢	30¢	H	32	M	.....	40	125
100	50	390	3	325	3	85	100	40¢	40¢	M	52	M	$35	73	73
70	70	150	15	150	15	100	100	25¢	25¢	H	21	M	None	54	54
130	74	178	16	194	....	100	....	25¢	25¢	H	.....	.....	.....	50	100
.....	.....	150	12	145	12	97	100	25¢	.....	H	25	M	None	50	.....
180	84	507	7	507	7	100	100	20¢	10¢	H	60	M	$15	43	60
100	41	310	.....	300	.....	90	90	25¢	25¢	M	40	M	None	58	79
200	76	420	6	420	6	100	100	27¢	7¢	M	76	M	$20	43	.....
100	96	120	.....	.....	.....	.....	.....	$1.50	.....	H	30	M	.....	50	80
150	61	500	185	465	170	94	93	25¢	15¢	H	84	M	$3	44	44
500	175	750	.....	750	.....	100	.....	50¢	10¢	H	70	M	.....	70	70
25	10	.....	.....	240	.....	.....	.....	25¢	25¢	H	27	M	.....	50	90
300	110	578	64	578	64	100	100	30¢	10¢	MH	52	M	$25	80	110
100	57	310	.....	310	.....	100	.....	47¢	.....	M	40	M	.....	60	110
180	180	198	.....	131	.....	66	.....	25¢	25¢	M	32	M	.....	58	58
250	105	652	75	520	132	80	100	25¢	25¢	H	70	M	$11.40	75	125
20	10	550	.....	550	.....	100	.....	35¢	35¢	H	92	M	.....	55	80
8	4	415	.....	415	.....	100	.....	50¢	40¢	H	47	M	.....	85	85
80	42	420	.....	420	.....	100	.....	37½¢	15¢	H	40	.....	None	50	63
.....	.....	150	.....	150	.....	100	.....	.....	.....	H	25	M	$12	55	100
650	236	550	.....	310	.....	56	.....	30¢	7.5¢	M	71	M	.....	55	65
.....	.....	515	97	4	11	1	11	50¢	50¢	P	24	P	$72.50	73	73
230	128	436	88	436	88	100	100	40¢	6.7¢	M	74	M	$48	45	100
35	35	250	.....	243	7	97	.....	$4.00	$1.35	P	.....	.....	.....	50	90
.....	.....	428	.....	.....	.....	.....	.....	.....	.....	.....	52	.....	.....	45	45
350	85	1,000	100	1,000	100	100	100	$3.25	65¢	P	44	M	$89	65	148
750	625	800	.....	.....	.....	.....	.....	.....	.....	.....	92	.....	.....	80	130
700	349	600	.....	500	.....	83	.....	20¢	20¢	P	19	M	.....	.....	100
27	23	238	6	238	6	100	100	67¢	10¢	M	28	M	None	43	43
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	32	M	.....	85	85
.....	.....	167	2	0	0	.....	.....	.....	.....	.....	30	M	.....	95	95
.....	.....	310	.....	6	.....	2	.....	20¢	.....	M	40	M	$25	100	100
.....	.....	20	1	0	0	0	0	.....	.....	.....	24	M	.....	52	52
30	25	120	.....	.....	.....	.....	.....	.....	.....	.....	23	M	None	85	85
.....	.....	200	.....	.....	.....	0	.....	.....	.....	.....	52	M	None	.....	78
.....	.....	291	.....	.....	.....	.....	.....	.....	.....	.....	38	.....	.....	55	125
.....	.....	150	.....	0	Few	.....	.....	.....	.....	P	32	P	$37.50	75	75
30	19	70	2	0	0	.....	.....	.....	.....	.....	14	M	None	25	.....
100	33	500	7	140	7	28	100	48¢	30¢	M	72	M	.....	74	74
35	30	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.. .	.....
23	10	300	.....	300	.....	100	.....	40¢	.....	M	55	M	.....	.....	78
500	184	2	.....	.....	.....	.....	.....	.....	.....	.....	57	.....	.....	108	108
5	4	286	0	286	0	100	0	50¢	50¢	M	.....	M	.....	.....	.....
300	133	445	.....	.....	.....	.....	.....	.....	.....	.....	80	MP	$25	70	70
.....	.....	80	.....	.....	.....	.....	.....	.....	.....	.....	34	M	$14.71	80	125
50	37	160	.....	2	.....	1	.....	.....	.....	.....	57	.....	.....	76	85
.....	.....	433	4	0	0	.....	.....	.....	.....	.....	48	M	$20.90	70	70
.....	.....	465	6	0	0	.....	.....	.....	.....	.....	64	M	$25	75	75
.....	.....	600	.....	0	1	.....	.....	.....	10¢	M	70	M	.....	75	80
.....	.....	300	.....	100	.....	33	.....	.....	.....	H	50	M	.....	130	130
300	73	758	5	10	2	1	40	25¢	13.5¢	M	98	M	.....	105	105
.....	.....	320	.....	0	0	.....	.....	.....	.....	.....	35	M	.....	100	100

Municipality Ownership of Water works	Population	Source Type	Source Aver. Miles from City	Storage	Filters	Sterilized	Distribution System Total Miles of Main	Distribution System Kind of Pipe Mains	Distribution System Kind of Pipe Services	Pipe Sizes Inches Mains	Pipe Sizes Inches Services	Pump Capacity m. g. d.	Main Supply Met-
NEW HAMPSHIRE (con.)													
Pembroke.....P	2,563	S	6.0	Pp	No	No	15.5	IW	G	6–12	.....	None	No
Peterboro.....M	2,615	S	3.0	R	No	Ch	10.8	IW	Wr Cl	4–12	¾–1	.....	No
Pittsfield.....P	1,914	S	2.0	R	No	No	6.5	IC	G Cl	2–10	.....	None	No
Plymouth.....M	2,353	U	1.5	R	.....	.....	9.5	IW	Wr	4–10	¾–2	0.1	No
Raymond.....M	1,050	U	0.2	Pp	No	No	3.0	I	G	6–10	¾–1½	0.8	No
Sunapee.....M	1,071	S	0.3	R	.....	.....	2.5	I	G	4–8	.....	0.3	...
Troy.....M	1,444	SU	3.0	.....	No	No	5.0	IW	G	6–12	¾	None	No
Warner.....M	1,051	SU	1.5	R	.....	.....	2.5	.....	.....	.....	.....	.....	...
Whitefield.....M	1,935	S	6.0	R	.....	.....	10.0	I	G	6–10	.....	.....	...
Wilton.....M	1,546	S	1.5	R	No	.....	6.0	I	G	4–12	.....	.....	No
Wolfboro.....M	2,178	S	4.5	RT	No	No	15.0	I	G	4–10	¾	.....	No
Woodstock.....M	1,083	S	2.0	.....	No	No	6.0	I St	G	½–8	.....	.....	...
Woodsville.....M	1,800	S	0.3	.....	No	Ch	5.0	I	Wr G	4–8	½–3	2.0	No
NEW JERSEY													
Atlantic Highlands.....M	2,015	U	0.5	Pp	O	No	18.0	I	G	4–10	.....	2.0	Yes
Belmar.....M	1,987	U	0.5	RPp	.....	.....	24.0	I	G	4–12	.....	3.3	No
Belvidere.....P	1,834	S	2.0	R	O	Ch	3.5	W	.....	4–8	.....	None	No
Blairstown.....P	1,301	SU	1.0	Pp	.....	.....	2.0	I	G	4–6	½–¾	0.2	No
Bogota.....P	3,906	S	....	R	A	Ch	....	.....	LB	.....	.....	.....	...
Bordentown.....M	4,800	U	3.0	T	.....	.....	7.0	I	L	4–10	¾–1	3.1	...
Caldwell.....	4,300	...	....	R	.....	.....	8.0	I	.....	.....	.....	.....	...
Cape May.....M	2,999	U	1.5	Pp	.....	.....	25.5	I	.....	4–16	.....	4.5	No
Carlstadt.....P	4,472	S	....	R	A	Ch	8.5	.....	BL	4–12	.....	.....	...
Chatham.....M	3,000	U	1.0	Pp	.. ..	.. ..	12.0	I	.. ..	4–10	.. ..	0.8	..
Dumont.....P	2,537	S	.. ..	R	A	Ch	.. ..	.. ..	BL	.. ..	.. ..	.. ..	..
Edgewater.....P	4,200	S	20.0	R	A	Ch	12.0	I	LB	6–30	¾–12	.. ..	..
Egg Harbor City .....M	3,500	U	1.0	Pp	.. ..	.. ..	9.5	I	G	4–12	.. ..	1.8	No
Fairview.....P	4,882	S	.. ..	R	A	Ch	.. ..	.. ..	BL	.. ..	.. ..	.. ..	..
Frenchtown.....P	1,104	S	0.1	R	O	Ch	3.0	IC	G	4–8	¾	0.02	No
Gladstone.....M	1,600	SU	....	.....	....	.. ..	5.6	I	.. ..	4–8	....	.. ..	No
Hackettstown.....M	2,936	SU	1.5	R	O	.. ..	12.0	I	G	4–12	¾	.. ..	No
Hasbrouck Hts.....P	2,895	S	....	R	A	Ch	....	.....	BL	.....	.....	.....	...
Hightstown.....M	2,674	U	0.0	T	A	.. ..	8.0	I	G	4–10	¾	1.5	Yes
Hoboken.....M	2,081	U	0.0	.....	.....	.....	3.0	I	L I	4–10	.....	.....	Yes
Hopewell.....M	1,844	U	0.1	R	.. ..	.. ..	4.0	I	I	3–8	.. ..	0.1	No
Jamesburg.....P	2,052	U	0.3	Pp	No	.....	4.8	IC	G	4–8	1	0.3	No
Lambertville.....P	4,660	U	1.5	R	O	No	8.0	I Wr	G	4–6	½–¾	0.7	No
Leonia.....P	2,979	S	...	R	A	Ch	...	.. ..	BL	.....	.....	.....	...
Little Falls.....P	4,300	....	0.8	.....	.....	.....	15.5	I	G	4–10	¾–2	.....	Yes
Little Ferry.....P	3,400	S	....	R	A	Ch	0.8	.....	LB	6–12	.....	.....	..
Lumberton.....P	600	S	0.5	Pp	No	Ch	2.0	I	G	4–8	½–1	0.8	No
Matawan.....M	1,910	U	0.3	PpT	O	.....	....	I	L	4–10	.....	0.5	No
Mays Landing.....M	2,000	U	0.0	Pp	No	No	9.0	I	IG	4–10	¾	0.06	No
Medford.....P	1,891	S	1.0	Pp	No	Ch	4.0	I	G	4–6	¾–1	0.4	No
Mendham.....M	1,000	SU	3.0	R	O	No	10.5	I	I	6–8	.....	.....	No
Metuchen.....P	3,334	U	....	RPp	No	Ch	....	I	.....	.....	.....	.....	...
New Egypt.....P	1,000	U	0.3	RT	No	No	4.1	I	G	1¼–6	¾	0.5	No
Newton.....M	4,125	S	9.8	R	No	No	26.0	I	GIi	2–12	.....	None	No
Palisades Park.....P	2,633	S	....	R	A	Ch	....	.....	BL	.....	.....	.....	...
Peetsburg.....P	2,000	S	....	R	A	Ch	....	.....	LB	.....	.....	.....	...
Pemberton.....P	800	S	0.0	Pp	No	Ch	2.5	I	G	2–6	¾	0.2	No
Piscataway.....P	2,500	U	....	RPp	No	Ch	....	I	.....	.....	.....	.....	...
Ramsey.....M	2,090	U	1.5	R	No	No	11.5	I	G	4–10	¾	0.6	Yes
Raritan.....P	4,457	U	....	RPp	No	Ch	....	I	.. ....	.. ....	.. ....	.. ....	..
Ridgefield.....P	1,560	S	....	R	A	Ch	....	.. ....	BL	.....	.....	.. ....	..
Sussex.....M	1,318	S	7.0	R	No	No	11.0	I	G	4–8	½–1	.....	No
Teaneck.....P	3,260	S	....	R	A	Ch	14.0	.....	BL	.....	.....	.....	...
Toms River.....P	3,000	U	0.5	Pp	No	No	8.0	I	G	3–8	.....	0.8	...
Washington.....P	3,341	U	2.8	R	.....	.....	11.0	I	I	4–10	¾	.....	No
Westwood.....P	2,597	S	....	R	A	Ch	9.0	I	BL	4–12	.....	.....	...
Woodridge.....P	1,923	S	....	R	A	Ch	3.5	.....	BL	.....	.....	.....	...
Woodtown.....M	1,589	U	0.3	RPp	.....	.....	6.0	I	G	4–8	.....	0.8	No
NEW MEXICO													
Alamogordo.....M	2,363	U	12.0	R	No	No	35.0	I	.....	¾–10	.....	None	...
Carlsbad.....P	2,300	U	1.0	RPp	No	No	10.0	I	G	4–12	¾–2	0.7	No
Clayton.....M	2,200	SU	3.0	RT	0	Ch	11.0	IW St	G	4–10	¾–2	0.8	Yes
Columbus.....M	2,110	U	0.0	T	No	No	5.0	I	G	3–8	¾–1¼	1.0	No
Deming.....M	3,212	U	0.5	Pp	No	No	8.0	I St	G	3–8	¾–6	3.7	Yes
Las Cruces.....M	3,960	U	0.0	RPpT	No	No	8.65	I	GL	2–8	¾	0.4	...
Magdalena.....P	1,000	U	1.25	RPp	.....	.....	2.0	.....	.....	3–5	.....	.....	...
Tucumcari.....M	3,117	U	0.2	RPp	.....	.....	10.0	W	G	4–10	¾	0.2	No

Consumption		Number of Services		Number of Meters		Per Cent Metered		Meter Rates per 1,000 Gallons		Meters Owned by	Hydrants			Average Pressure lbs. per sq. in.	
Average Daily in 1,000 gals.	Per Capit	Domestic	Industrial	Domestic	Industrial	Domestic	Industrial	Max. Dom.	Min. Ind.		Number	Owned by	Aver. Rental each per year	Domestic	Fire
.....	.....	400	.....	0	0	.....	.....	.....	.....	.....	51	M	$25	60	75
.....	.....	350	.....	80	.....	23	.....	.....	.....	M	72	M	.....	93	93
.....	.....	400	10	0	9	.....	.....	22¢	9¢	P	40	P	$33	60	80
100	43	450	.....	450	.....	100	.....	.....	.....	M	73	M	.....	70	70
70	67	150	3	0	1	0	33	.....	13¢	H	29	M	$41.38	63	75
30	28	100	.....	6	.....	6	.....	.....	.....	.....	30	.....	.....	130	130
.....	.....	200	2	30	0	15	0	.....	.....	M	46	M	.....	115	115
75	71	.....	.....	.....	.....	.....	.....	.....	.....	.....	35	M	.....	76	87
.....	.....	346	.....	.....	.....	.....	.....	.....	20¢	.....	50	M	.....	95	95
.....	.....	295	.....	2	.....	1	.....	.....	.....	M	53	M	.....	100	100
.....	.....	650	.....	5	.....	1	.....	30¢	30¢	M	70	M	$25	115	115
.....	.....	90	.....	.....	.....	.....	.....	.....	.....	.....	26	M	.....	94	94
450	250	215	.....	0	5	0	.....	.....	.....	M	30	M	$20	75	115
300	149	350	.....	930	.....	100	.....	38¢	.....	M	76	M	.....	120	140
700	351	1,600	.....	1,225	.....	75	.....	34¢	17¢	M	142	.....	.....	45	50
.....	.....	660	20	.....	20	.....	100	.....	.....	P	23	P	$28.70	80	95
20	15	35	.....	84	.....	100	.....	15¢	.....	P	20	P	None	67	100
.....	.....	.....	.....	.....	.....	100	100	16¢	12¢	P	.....	P	$10	.....	.....
700	146	1,000	.....	200	.....	20	.....	30¢	15¢	M	64	M	None	68	.....
.....	.....	335	.....	335	.....	100	.....	.....	.....	.....	105	M	None	62	.....
1,425	475	1,383	.....	9	.....	.....	.....	20¢	20¢	...	150	...	...	58	58
.....	.....	.....	.....	.....	.....	100	100	16¢	12¢	P	20	P	$10	20	50
400	133	688	.....	688	....	100	. ...	30¢	.....	M	116	M	.....	83	115
.....	.....	.....	.....	.....	.....	100	100	16¢	12¢	P	.....	P	$10	60	60
.....	.....	.....	.....	.....	.....	100	100	16¢	12¢	P	115	P	$10	75	75
.....	.....	.....	.....	.....	.....	33	.....	35¢	15¢	M	57	M	.....	40	90
.....	.....	.....	.....	.....	.....	100	.....	16¢	12¢	P	.....	P	$10	.....	.....
100	91	230	6	.....	6	0	100	.....	15¢	P	24	P	$40	60	60
123	77	234	.....	234	.....	100	.....	33¢	8¢	M	46	M	.....	140	140
.....	.....	.....	.....	.....	14	.....	.....	21¢	5¢	M	70	M	.....	105	105
.....	.....	.....	.....	.....	.....	100	.....	16¢	12¢	P	.....	P	$10	.....	.....
275	103	625	100	550	100	88	100	38¢	15¢	M	55	M	.....	53	66
.....	.....	148	.....	148	.....	100	.....	40¢	.....	M	36	M	$25	80	80
50	27	330	.....	330	.....	100	.....	30¢	30¢	M	24	M	.....	110	110
91	44	335	3	100	5	30	100	25¢	17¢	P	42	P	$25	50	50
300	64	250	12	.....	12	.....	100	.....	.....	P	50	M	.....	70	70
.....	.....	.....	.....	.....	.....	100	.....	16¢	12¢	P	.....	P	$10	.....	.....
231	54	915	.....	915	.....	100	.....	30¢	19¢	P	176	P	.....	126	126
.....	.....	.....	.....	.....	.....	100	100	16¢	12¢	P	45	P	$5	90	100
23	38	127	2	1	0	1	.....	30¢	30¢	P	21	P	$20	55	100
175	92	525	.....	525	.....	100	.....	.....	.....	M	53	M	.....	.....	.....
60	30	279	.....	279	100	100	.....	33¢	20¢	M	61	M	.....	55	55
60	32	250	.....	0	.....	0	.....	.....	.....	.....	25	P	$25	40	60
50	50	220	.....	220	.....	100	.....	33¢	.....	M	81	M	.....	80	80
.....	.....	.....	.....	.....	.....	100	100	.....	.....	P	.....	P	$10	.....	.....
45	45	156	2	156	2	100	100	40¢	40¢	P	25	P	$20	43	43
1,000	243	1,200	5	800	5	67	100	25¢	4¢	M	116	M	None	85	85
.....	.....	.....	.....	.....	.....	100	.....	16¢	12¢	P	.....	P	$10	70	.....
.....	.....	.....	.....	.....	.....	100	100	16¢	12¢	P	35	P	$10	.....	.....
75	94	240	1	.....	1	.....	100	25¢	.....	P	19	P	$25	35	.....
.....	.....	.....	.....	.....	.....	100	100	.....	.....	P	.....	P	$10	.....	.....
120	57	472	.....	472	.....	100	.....	30¢	.....	M	111	M	$25	80	.....
.....	.....	.....	.....	.....	.....	100	100	.....	... .	P	...	.....	$10	.....	.....
375	285	360	6	.....	.....	100	.....	16¢	12¢	P	.....	P	$10	30	30
.....	.....	.....	.....	.....	.....	.....	.....	21.3¢	5.3¢	M	50	M	.....	125	125
.....	.....	.....	.....	.....	.....	100	.....	16¢	12¢	P	80	P	$10	.....	50
125	42	455	.....	.....	15	.....	.....	30¢	15¢	.....	50	.....	.....	60	90
.....	.....	1,000	.....	.....	13	.....	.....	.....	10¢	P	51	M	$12	80	.....
.....	.....	.....	.....	.....	.....	100	.....	16¢	12¢	P	54	P	$10	75	.....
.....	.....	80	.....	80	.....	100	.....	16¢	12¢	P	20	P	$10	.....	.....
144	91	215	.....	75	.....	95	.....	.....	.....	M	68	M	.....	58	60
400	109	600	.....	575	.....	96	.....	27¢	.....	M	36	M	None	100	100
350	152	542	4	532	4	98	100	30¢	15¢	P	33	P	$45	38	68
200	91	387	109	387	109	100	100	60¢	40¢	M	53	M	None	60	60
50	24	120	.....	105	.....	88	.....	$1	.....	M	23	M	$12	36	50
201	63	687	207	575	118	84	57	28¢	16¢	M	38	M	$40	30	60
400	100	550	.....	250	.....	45	.....	50¢	15¢	M	50	.....	.....	30	40
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7	P	.....	.....	75
125	40	850	.....	700	.....	82	.....	67¢	.....	M	49	M	.....	46	70

Municipality Ownership of Water works	Population	Source Type	Source Aver. Miles from City	Storage	Filters	Sterilized	Distribution System Total Miles of Main	Distribution System Kind of Pipe Mains	Distribution System Kind of Pipe Services	Pipe Sizes Inches Mains	Pipe Sizes Inches Services	Pump Capacity m. g. d.	Main Supply Metered
NEW YORK													
Adams.....M	1,600	U	0.5	RPpT	No	No	4.5	I	G	4-8	¾-4	1.4	No
Afton.....M	875	U	5.0	RPp	No	No	10.0	I	G	4-8	.....	None	No
Akron.....M	1,960	U	0.2	RPp	No	Ch	6.0	I	G	4-10	¾-1½	0.5	No
Alden.....M	2,433	SU	1.0	Pp	.....	.....	6.0	I	I	4-10	.....	0.1	...
Amenia.....P	1,831	S	1.0	RPp	.....	.....	1.5	IW Wr	G	1-6	1½-3¼	0.4	No
Amityville.....P	3,265	U	0.3	RPp	No	No	11.5	I	G	4-10	¾-2	1.3	No
Andover.....M	1,809	U	1.0	R	No	No	6.0	I	L	6	¾	None	No
Angelica.....M	1,502	U	5.0	R	.....	.....	9.0	I	G	4-8	.....	0.3	...
Angola.....M	2,000	S	3.0	Pp	O	No	12.0	I St	G	2-10	.....	0.5	No
Antwerp.....M	2,569	S	0.0	Pp	.....	Ch	3.25	I	G	4-8	¾-2	0.9	No
Attica.....M	2,015	U	3.0	R	.....	.....	7.5	I	Wr	4-10	.....	.....	...
Ausable Forks.....P	2,000	S	1.0	.....	No	No	3.0	I	G	4-6	.....	None	No
Avoca.....M	1,888	SU	2.0	R	No	No	7.0	I	Wr	4-8	.....	None	No
Avon.....M	2,737	S	3.0	R	.....	Ch	40.0	IW	GL	4-12	¾-2	None	No
Belmont.....M	1,552	SU	4.0	R	No	No	9.0	I	G	4-10	¾-1¼	None	No
Berlin.....P	1,305	S	1.0	R	No	No	1.5	I	G	4-6	.....	None	No
Black River.....M	916	U	1.5	RT	No	.....	4.0	I	G	4-10	.....	10.8	No
Blasdell.....M	1,401	....	2.0	.....	.....	.....	8.0	I	L	2-6	2-6	.....	...
Boonville.....M	2,000	S	....	R	No	No	8.0	I	.....	4-12	½-1	None	No
Brewster.....M	1,296	U	0.5	R	No	.....	4.0	I	G	4-8	.....	0.3	No
Briarcliff Manor.....M	2,200	U	1.0	T	No	Ch	20.0	I	G	4-10	¾-2	1.4	No
Brockport.....M	2,980	S	10.0	RPp	A	Ch	17.0	I	G	4-14	¾	1.5	Yes
Cairo.....P	1,487	SU	4.5	R	No	.....	2.8	I	GL	4-12	.....	.....	No
Callicoon.....P	900	U	.....	R	No	No	2.5	I	G	4-8	½-¾	0.04	No
Cambridge.....P	1,528	U	2.5	R	No	No	6.5	I	G	6-8	¾	0.5	No
Camden.....M	3,054	SU	3.5	R	.....	.....	10.0	I	I	4-12	.....	.....	...
Canajoharie.....M	2,415	U	13.0	R	.....	.....	19.0	IW	G	4-12	¾-3	0.2	...
Canisteo.....P	2,201	U	2.0	R	A	.....	8.0	I	GL	4-10	.....	None	No
Canton.....M	2,631	U	8.0	RPp	No	Ch	8.5	I	G	4-12	¾-2	2.0	Yes
Cape Vincent.....M	1,000	S	0.3	Pp	No	Ch	7.0	I	G	4-10	¾	2.3	No
Carthage.....M	4,320	SU	15.0	RPp	.....	.....	15.7	I	G Wr	4-12	¾-1	2.0	No
Castleton.....M	1,583	U	3.0	.....	.....	.....	5.0	I	G	8-12	.....	.....	...
Catskill.....M	4,728	S	0.5	R	No	Ch	16.5	I	L	4-12	½-¾	2.5	Yes
Cattaraugus.....M	1,165	U	4.5	R	.....	.....	9.5	I	Wr	3-8	.....	.....	...
Casenovia.....M	3,343	U	2.0	R	.....	.....	7.0	I	L	4-10	.....	0.5	...
Champlain.....M	1,280	S	1.3	T	No	Ch	5.0	I	IL	4-8	.....	0.7	No
Cherry Creek.....M	1,204	U	2.0	R	No	No	....	I	G	4-8	.....	None	No
Cherry Valley.....M	750	S	1.5	R	O	.....	3.5	I	G	3-10	¾	None	No
Chester.....M	1,203	S	5.0	R	.....	.....	8.0	I	L	4-12	.....	None	No
Cincinnatus.....M	965	U	2.0	R	No	No	....	.....	.....	4-8	.....	None	No
Clayton.....M	3,618	S	0.5	R	No	Ch	7.0	I	I	4-10	.....	.....	No
Clifton Springs.....M	1,600	U	5.0	RPp	No	No	10.0	.....	.....	4-10	¾	None	No
Clymer.....P	200	U	1.0	T	.....	.....	2.0	I	I	3	½-1	.....	No
Cobleskill.....M	2,500	U	3.0	R	A	Hy	7.0	I	L	4-10	½-2	.....	Yes
Cohocton.....M	2,585	U	2.0	R	No	No	....	.....	G	4-8	¾-1	0.5	No
Cooperstown.....P	2,725	S	0.5	R	No	Ch	8.0	I	GL	¾-14	½	.....	No
Corinth.....M	2,576	S	2.5	RPp	No	Ch	7.0	I	G	4-10	.....	0.1	No
Cornwall.....M	4,259	SU	2.0	R	No	No	9.0	I	I	4-10	.....	.....	Yes
Crown Point.....P	1,413	U	3.0	R	No	No	3.5	I	I	3-4	.....	None	No
Cuba.....M	2,395	U	2.5	R	.....	.....	10.0	I	.. ..	4-8	.. ....	0.2	No
Dansville.....M	4,630	SU	2.5	R	.....	Ch	16.5	I	GL	4-12	½-¾	.....	...
Delhi.....M	1,800	S	1.0	R	O	.....	10.0	I	GL	3-12	.....	.....	No
DeRuyter.....M	587	U	3.0	R	O	No	5.5	I	G	4-8	.....	.....	No
Dolgeville.....M	3,600	SU	4.5	R	No	No	15.0	.....	G	4-12	½-1	.. ....	...
East Syracuse.....M	4,106	U	6.0	R	.....	.....	16.5	I	I	4-12	½	.....	...
Edmeston.....P	800	U	2.0	R	No	No	4.5	I	.....	4-10	¾-1½	None	No
Edwards.....MP	1,497	S	0.0	RPp	No	No	1.8	I	I	4-6	½-1½	0.3	No
Elisabethtown.....P	1,042	U	2.0	R	.....	No	0.4	I	G	3-6	¾	None	...
Ellenville.....M	3,116	S	1.0	R	No	Ch	10.5	I	G Wr	4-10	.....	None	No
Ellicottville.....M	780	SU	2.0	R	.....	.....	1.9	I	.....	4-8	.....	1.0	...
Falconer.....M	2,742	U	1.3	R	No	No	7.0	I	G	6-16	½-6	5.0	Yes
Farmingdale.....M	2,091	U	0.0	RT	.....	.....	12.0	I	I	2-10	.....	3.5	No
Fort Plain.....M	2,800	U	8.0	R	.....	.....	15.0	I	G	4-12	.....	.....	No
Franklinville.....M	2,015	U	2.8	R	.....	.....	13.0	.....	G	4-8	.....	2.6	...
Garden City.....M	3,500	U	1.0	Pp	No	No	35.0	I	Wr L	4-18	1¼-2	10.0	No
Geneseo.....M	2,157	S	5.0	R	No	Ch	13.0	I	L	4-12	½-1	2.3	Yes
Gowanda.....M	2,673	U	1.5	R	No	No	7.5	I St	G	4-8	¾	0.2	No
Great Neck.....P	4,500	U	1.0	.....	No	No	27.2	I	LG	4-16	½-4	5.0	No
Greene.....M	2,917	U	4.0	R	No	No	10.0	I St	St	4-10	.....	.....	No
Greenwich.....P	2,384	SU	3.5	R	No	Ch	11.0	I	G	4-8	.....	.....	No
Groton.....M	2,235	U	2.0	.....	No	No	....	.....	G	4-10	.....	None	No
Hamburg.....M	4,500	U	0.8	Pp	O	.....	8.0	I	G	4-10	.....	2.75	No
Hamilton.....M	1,689	SU	1.5	PpT	O	Ch	14.0	I	G	4-10	½-2	1.2	No
Harrisville.....M	991	S	1.0	Pp	No	....	5.0	.....	G	6	¾	0.4	No
Hartwick.....P	1,648	U	1.0	R	No	No	1.0	I	G	½-6	½	0.1	No

Consumption		Number of Services		Number of Meters		Per Cent Metered		Meter Rates per 1,000 Gallons		Meters Owned by	Hydrants			Average Pressure lbs. per sq. in.	
Average Daily in 1,000 gals.	Per Capita	Domestic	Industrial	Domestic	Industrial	Domestic	Industrial	Max. Dom.	Min. Ind.		Number	Owned by	Aver. Rental each per year	Domestic	Fire
220	137	375	10	360	10	93	100	75¢	7.5¢	M	33	M	$60	60	60
70	80	500	10	96	15	19	100	30¢	15¢	H	34	M	None	80	.....
200	102	480	.....	.....	.....	.....	.....	.....	.....	.....	54	M	None	95	120
42	17	260	5	260	5	100	100	30¢	22.5¢	.....	48	M	.....	38	85
30	16	80	.....	2	.....	2	.....	40¢	40¢	P	14	P	$22.50	65	65
300	92	600	.....	12	.....	2	.....	.....	.....	PH	18	P	$35	50	50
.....	.....	431	6	0	6	0	100	.....	$1	M	50	M	None	85	85
50	33	250	.....	75	.....	30	.....	56¢	38¢	H	40	.....	.....	60	60
500	250	404	4	404	4	100	100	60¢	7.5¢	M	60	M	None	65	100
150	58	300	.....	300	.....	100	.....	20¢	5¢	H	50	P	None	60	145
300	149	340	.....	5	.....	1	.....	12¢	.....	.....	40	.....	.....	30	85
.....	.....	.....	.....	0	.....	.....	.....	.....	.....	.....	10	P	.....	60	.....
.....	.....	200	.....	0	.....	.....	.....	.....	.....	.....	40	M	.....	55	75
300	109	567	.....	567	.....	100	.....	30¢	7.5¢	H	52	M	$35	70	75
.....	.....	250	10	250	10	100	100	57¢	27.5¢	H	50	M	None	.....	75
100	77	90	2	0	0	0	0	.....	.....	.....	18	P	$21.76	80	98
54	59	.....	8	.....	8	75	100	50¢	25¢	M	28	M	None	100	90
.....	.....	350	10	350	10	100	100	15¢	13¢	M	50	M	.....	90	90
200	100	479	2	450	2	94	100	25¢	3¢	M	57	M	None	83	83
90	60	400	50	0	10	0	20	40¢	.....	M	54	M	.....	70	70
500	227	325	.....	325	.....	100	.....	40¢	.....	H	90	M	None	175	175
500	168	1,137	7	1,137	7	100	100	50¢	10¢	MH	86	M	.....	75	75
.....	.....	110	.....	.....	4	.....	.....	.....	.....	P	28	P	.....	52	52
.....	.....	84	.....	14	.....	17	.....	25¢	.....	P	24	.....	.....	76	76
.....	.....	473	0	382	0	81	0	50¢	20¢	PH	44	P	$42.40	85	85
.....	.....	400	.....	.....	.....	.....	.....	.....	.....	.....	50	.....	.....	75	75
350	145	585	9	620	13	100	100	20¢	10¢	M	80	M	.....	67	97
150	68	712	.....	447	.....	63	.....	30¢	10¢	H	62	P	.....	71	71
450	171	750	.....	.....	.....	.....	.....	.....	.....	.....	89	M	.....	50	50
150	150	150	20	38	12	25	60	20¢	10¢	M	58	M	$12.90	45	50
850	197	954	.....	600	.....	63	.....	48¢	8¢	H	106	M	.....	85	85
.....	.....	120	.....	.....	.....	.....	.....	.....	.....	.....	46	M	.....	96	96
73	15	1,351	5	300	5	22	100	13¢	13¢	M	145	M	.....	90	90
.....	.....	250	.....	.....	.....	.....	.....	.....	.....	.....	32	.....	.....	110	117
.....	.....	510	.....	510	.....	100	.....	.....	.....	.....	50	.....	.....	62	62
200	156	300	.....	.....	.....	.....	.....	.....	.....	.....	43	.....	.....	45	100
.....	.....	125	2	33	.....	26	.....	.....	8¢	H	40	M	.....	53	87
.....	.....	240	.....	0	.....	0	.....	.....	.....	.....	36	M	None	65	70
.....	.....	250	.....	.....	5	.....	.....	None	10¢	M	40	M	None	100	100
Unknown	.....	90	.....	80	.....	89	.....	40¢	25¢	H	18	.....	.....	70	70
.....	.....	.....	.....	.....	.....	100	.....	.....	40¢	M	55	M	.....	.....	60
150	94	450	1	150	.....	33	.....	15¢	9¢	M	59	M	.....	100	100
0.6	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	18	M	$8.16	40	.....
400	160	500	26	.....	26	.....	100	.....	4¢	M	78	M	None	90	90
.....	.....	270	5	270	5	100	100	30¢	25¢	H	45	M	.....	120	120
500	183	864	.....	864	.....	100	.....	27¢	27¢	P	65	P	$20	70	100
200	78	554	6	0	0	0	0	.....	.....	.....	56	M	$25	90	125
750	176	890	.....	10	.....	1	.....	30¢	8¢	H	100	M	$25	120	120
.....	.....	60	.....	3	.....	5	.....	.....	.....	P	1	H	.....	35	80
.....	.....	350	.....	.....	.....	.....	.....	.....	.....	.....	58	M	.....	88	88
1,000	216	1,240	.....	.....	6	.....	.....	12¢	2¢	M	124	.....	.....	75	75
.....	.....	460	.....	.....	6	.....	.....	.....	20¢	M	112	M	.....	88	88
.....	.....	198	.....	0	.....	0	.....	.....	.....	.....	17	M	.....	109	109
.....	.....	750	.....	.....	.....	.....	.....	.....	.....	.....	72	M	.....	125	145
400	97	750	.....	750	.....	100	.....	67¢	.....	H	77	.....	.....	100	.....
100	125	100	4	0	2	0	50	.....	15¢	P	20	P	$40	60	80
20	13	150	.....	.....	1	.....	.....	.....	20¢	M	21	M	.....	50	50
.....	.....	175	.....	0	0	0	0	.....	.....	.....	24	P	.....	120	120
710	225	640	.....	.....	20	.....	.....	25¢	12.5¢	M	102	M	None	60	100
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	30	M	.....	43	75
18	7	723	.....	648	.....	90	.....	27¢	27¢	M	28	M	$40	65	125
3,325	.....	783	5	0	5	0	100	.....	15¢	M	89	M	.....	70	105
500	179	725	.....	50	.....	69	.....	22.7¢	3.7¢	M	83	.....	.....	90	90
180	90	400	16	90	10	23	17	25¢	10¢	H	54	M	.....	80	80
1,000	286	831	.....	691	.....	83	.....	25¢	.....	M	355	M	.....	75	100
216	100	655	.....	552	.....	84	.....	40¢	.....	M	92	M	None	95	115
350	131	800	0	475	0	60	0	33¢	10¢	M	51	M	$40	72	72
500	111	1,200	0	1,200	0	100	0	27¢	.....	H	250	P	.....	100	100
40	14	350	50	350	50	100	100	20¢	8¢	M	38	M	None	80	80
250	105	500	.....	500	.....	100	.....	40¢	20¢	PH	52	P	$47.30	60	125
.....	.....	550	10	530	10	96	100	34¢	3¢	M	55	M	None	80	90
.....	.....	800	10	1000	.....	13	.....	25¢	15¢	M	54	M	$55	55	100
150	89	460	.....	460	.....	100	.....	33¢	13¢	.....	76	M	None	100	100
80	81	.....	.....	0	0	.....	.....	.....	.....	.....	40	M	.....	45	60
Unknown	.....	125	2	2	1	.....	.....	25¢	25¢	P	21	P	$15	95	95

Municipality Ownership of Water works	Population	Source		Storage	Filters	Sterilised	Distribution System			Pipe Sizes Inches		Pump Capacity m. g. d.	Main Supply Metered
		Type	Aver. Miles from City				Total Miles of Main	Kind of Pipe		Mains	Services		
								Mains	Services				
New York (con.)													
Holland.....P	1,410	U	1.0	R	No	No	2.0	W	G	4-10	.....	0.04	No
Holley.....M	1,679	U	1.5	Pp	No	No	5.0	I	G	4-8	¾	2.0	No
Homer.....M	2,356	U	1.0	Pp	.....	.....	9.0	I	I	3-8	.....	0.2	No
Honeoye Falls.....M	1,200	U	0.2	RT	No	Ch	6.0	.....	.....	4-8	.....	0.05	No
Hoosick Falls.....M	4,896	U	0.5	Pp	.....	Ch	13.0	IC	G	4-12	2	3.6	...
Horseheads.....M	2,078	U	0.8	R	No	No	10.8	I	GL	4-10	½-1	0.3	No
Jordan.....P	1,000	U	2.0	R	No	No	5.0	IC	G	4-8	.....	0.1	No
Katonah.....M	1,200	U	0.3	Pp	No	No	3.0	I	.....	4-8	.....	.....	...
Keesville.....M	1,835	S	5.0	R	A	No	6.0	I	G	2-10	¾-2	None	No
Lake George.....P	752	S	2.0	R	A	.....	6.0	I	G	2-8	.....	None	No
Lake Placid.....M	2,300	S	1.0	R	No	Ch	5.0	I	G	2-12	.....	5.1	No
Larchmont.....M	4,200	S	1.5	R	F	Ch	17.0	I	L	6-12	1	None	Yes
LeRoy.....M	4,203	S	5.5	RPp	A	No	19.0	I	G	4-16	¾-4	None	No
Liberty.....M	2,459	S	6.0	R	No	Hy	17.5	I	I	4-12	.....	0.2	No
Lima.....M	1,890	U	1.0	RPp	No	No	7.3	I	G	4-8	½-2	3.7	No
Little Valley.....P	1,683	U	2.0	R	No	No	4.0	Wr	G	4-6	½-¾	0.1	No
Locust Valley.....M	2,500	U	0.1	Pp	No	.....	19.0	I	G	6-12	1-6	0.6	No
Lowville.....M	3,127	U	10.0	R	No	.....	24.0	I	G	4-16	.....	.....	...
Lyndonville.....M	841	S	4.5	RT	O	.....	7.0	I	.....	4-10	.....	0.8	...
Manlius.....M	1,400	U	2.0	R	No	No	10.0	I	G	4-8	½-1	0.3	No
Marathon.....M	1,079	U	4.5	R	No	No	9.0	I	G	4-8	¾-2	.....	No
Marcellus.....M	990	S	3.0	.....	No	No	6.0	I	G	4-10	4-6	.....	No
Millerton.....M	890	U	0.8	R	No	No	5.0	I	G	4-8	¾	0.8	No
Mohawk.....M	2,919	U	0.1	Pp	.....	.....	6.0	I	I	4-8	.....	3.0	No
Monroe.....M	1,600	U	3.0	R	No	No	0.4	I	GB	4-18	.....	None	No
Montgomery.....M	941	U	0.5	Pp	No	.....	4.0	I	LG	4-8	.....	0.8	...
Montour Falls.....M	1,967	SU	1.8	R	No	No	7.0	I	G	4-8	.....	None	No
Morris.....M	600	SU	2.0	R	O	No	6.0	I	G	1-4	¾-1	None	No
Morristown.....M	1,719	S	....	.....	.....	.....	1.4	.....	.....	.....	.....	0.6	...
Mount Morris.....M	3,812	S	11.0	R	A	Ch	20.0	I	G	4-12	.....	.....	Yes
Naples.....M	2,122	U	2.0	RPp	.....	Ch	6.8	I	I	4-8	.....	.....	No
Nassau.....M	2,015	U	1.3	.....	.....	.....	3.0	I	.....	4-8	.....	0.3	...
Newark Valley.....M	1,000	U	3.0	R	No	No	6.3	I	Wr	4-8	½-¾	0.3	No
North Collins.....M	1,200	U	1.5	Pp	No	No	6.0	I	G	4-8	¾-1	0.3	No
Northport.....P	2,096	U	1.0	RT	No	No	10.0	I St	G	3-10	1	1.1	Yes
Northville.....M	1,200	SU	1.0	.....	No	No	1.9	W	G	4-10	¾	None	No
Norwood.....M	1,993	S	0.3	Pp	.....	.....	7.0	I	G	4-10	.....	0.9	No
Nunda.....M	1,220	U	3.0	R	No	No	6.5	IW	G	4-12	¾-2	None	No
Oakfield.....M	2,438	U	0.5	RPp	No	Ch	4.5	I	G	6-10	¾	0.4	No
Ontario.....M	2,620	S	1.5	RT	No	No	5.0	I	.....	6-8	.....	.....	...
Otego.....M	1,366	SU	....	R	.....	.....	6.0	I	G	4-6	.....	None	No
Ovid.....M	2,855	S	....	Pp	No	No	0.2	I	.....	8	.....	0.7	No
Oxford.....M	1,600	U	4.0	R	No	No	9.0	I	Wr	4-10	¾	0.5	No
Pavilion.....P	550	U	1.0	R	No	No	2.0	I St	GL	1-4	.....	.....	No
Pawling.....M	1,035	S	3.0	R	No	No	7.0	I	I	4-10	⅝	None	No
Penn Yan.....M	4,980	S	2.0	R	.....	.....	15.5	I	G	4-12	.....	1.5	Yes
Phelps.....M	1,354	U	3.0	.....	No	No	3.5	I	G	4-8	½-2	None	No
Philadelphia.....M	1,100	U	5.5	R	No	No	....	I	G	4-12	.....	None	No
Phoenix.....M	1,700	S	0.0	Pp	No	.....	7.0	I	G	4-8	¾-1	.....	No
Poland.....M	358	U	1.0	R	No	No	3.0	I	G	4-8	¾	None	No
Port Byron.....M	1,085	S	....	R	.....	.....	4.0	I	.....	4-6	.....	0.1	...
Port Henry.....M	2,183	SU	2.5	R	O	No	10.0	I	I	4-10	.....	.....	No
Portville.....M	2,164	U	3.0	R	No	No	....	I	I	4-6	¾-1	None	No
Port Washington.....M	3,000	U	1.0	PpT	No	No	30.0	I	G	4-12	¾	1.3	Yes
Potsdam.....M	4,039	S	....	.....	.....	.....	17.0	IW	G	4-10	¾-2	4.2	No
Randolph.....M	1,341	U	2.3	R	.....	.....	6.5	I	WrG	4-8	.....	.....	...
Ravenna.....M	2,093	S	3.0	R	No	Hy	12.0	I	GL	4-12	½	.....	No
Red Hook.....M	960	U	2.0	R	No	No	6.0	I	G	4-8	½	0.3	No
Rhinebeck.....P	2,770	U	1.3	.....	.....	.....	8.0	I	I	4-8	.....	0.6	No
Richmondsville.....M	1,378	U	3.0	R	No	No	5.6	.....	G	4-10	½-2	.....	...
Ripley.....P	2,116	S	2.0	R	O	No	3.0	I	G	4-8	¾	None	No
Riverhead.....M	3,000	U	1.0	T	So	.....	10.0	I	G	6-12	1	0.7	No
Rosendale.....M	1,959	U	2.0	R	No	No	7.0	I	.....	4-6	.....	.....	...
Rouse's Point.....M	1,638	S	0.0	None	No	Ch	7.0	I	G	4-10	.....	1.0	No
Roxbury.....P	500	U	1.0	R	No	No	3.0	I	G	4-8	¾	None	No
St. Johnsville.....M	2,469	U	7.0	R	No	Ch	12.0	I	G	4-10	.....	None	Yes
Saugerties.....M	4,013	SU	6.0	R	.....	Ch	15.0	I	GLB	4-16	.....	.....	No
Schoharie.....M	2,132	U	2.0	R	.....	.....	5.0	.....	.....	4-8	.....	.....	...
Sherman.....M	1,467	U	0.8	R	No	No	4.0	I	.....	4-6	.....	.....	No
Shortsville.....M	1,228	U	0.9	RPp	No	No	4.5	I	L Wr	4-10	.....	0.7	No
Sidney.....M	2,670	SU	2.3	R	O	No	14.0	I	.....	4-12	¾-1½	None	No
Silver Springs.....M	1,155	U	2.0	R	No	No	3.0	I	G	4-8	½	0.4	No
Skaneateles.....M	1,700	S	0.8	R	No	Ch	6.0	I	I	4-8	½-1	1.4	No
Sodus.....M	1,500	U	0.5	R	No	No	5.0	I	Wr	6-8	¾	0.3	No
Southampton.....P	3,500	U	1.0	R	No	No	25.0	I	G	4-8	.....	1.5	No

Consumption		Number of Services		Number of Meters		Per Cent Metered		Meter Rates per 1,000 Gallons		Meters Owned by	Hydrants			Average Pressure lbs. per sq. in.	
Average Daily in 1,000 gals.	Per Capita	Domestic	Industrial	Domestic	Industrial	Domestic	Industrial	Max. Dom.	Min. Ind.		Number	Owned by	Aver. Rental each per year	Domestic	Fire
500	354	100	.....	0	0	0	0	.....	.....	.....	18	.....	.....	80	70
100	60	525	.....	500	.....	90	.....	50¢	15¢	M	43	M	$60	.....	60
150	64	400	125	400	.....	100	.....	25¢	18¢	H	55	.....	.....	100	100
50	42	275	6	275	6	100	100	25¢	12½¢	M	60	.....	None	58	58
1,080	220	2,000	67	.....	10	15	.....	.....	8¢	M	101	.....	.....	100	100
95	46	535	7	500	7	93	100	25¢	10¢	H	95	M	.....	95	95
43	43	175	0	4	0	2	0	40¢	.....	H	34	P	$40	55	55
35	29	260	0	0	0	0	0	.....	.....	.....	57	M	.....	100	120
6	3	175	0	86	0	49	0	.....	.....	.....	51	M	None	80	100
.....	.....	200	20	.....	.....	.....	.....	.....	.....	.....	65	M	$10	120	120
960	418	600	.....	100	.....	17	.....	20¢	.....	M	50	M	.....	105	105
360	96	870	.....	1,100	.....	100	.....	67¢	.....	M	94	M	$40	32	40
200	48	1,100	13	1,100	13	100	100	25¢	10¢	M	118	M	$30	70	70
300	124	1,000	6	1,000	6	100	100	25¢	15¢	MH	90	M	None	125	125
100	53	250	.....	250	.....	100	.....	33¢	12¢	H	50	M	None	60	60
.....	.....	312	5	0	0	0	0	.....	.....	.....	35	M	None	75	90
200	80	.....	0	.....	0	100	0	50¢	20¢	H	190	M	.....	100	100
25	8	946	.....	940	.....	99	.....	27¢	.....	.....	114	M	None	67	67
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	M	.....	50	.....
20	14	368	7	368	7	100	100	81¢	7¢	H	44	M	.....	100	100
.....	.....	375	5	0	2	.....	40	.....	.....	M	55	M	None	80	80
Unknown	.....	185	5	0	0	0	0	.....	.....	.....	.....	M	$25	90	140
180	202	206	4	7	4	3	100	30¢	7¢	M	34	M	.....	95	95
375	128	750	4	360	4	48	100	30¢	5¢	M	67	.....	.....	85	85
.....	.....	450	.....	0	1	.....	.....	.....	.....	H	94	M	.....	106	106
45	48	175	.....	50	.....	29	.....	35¢	30¢	MH	34	.....	.....	60	65
.....	.....	230	3	1	0	.....	.....	18¢	.....	M	60	M	.....	80	80
Unknown	.....	163	3	0	0	0	0	.....	.....	.....	28	M	.....	75	75
.....	.....	45	2	4	2	80	100	60¢	60¢	H	25	.....	.....	60	100
500	131	720	.....	5	25	.....	.....	40¢	5¢	MH	100	M	.....	95	113
Unknown	.....	350	.....	.....	4	.....	.....	.....	.....	M	62	M	None	85	85
.....	.....	120	.....	0	.....	.....	.....	.....	.....	.....	28	.....	.....	65	65
72	72	200	.....	.....	7	0	.....	.....	.....	H	52	M	.....	75	83
100	83	301	2	299	2	100	100	25¢	15¢	M	56	M	$25	50	63
180	86	750	100	400	50	53	50	60¢	60¢	H	53	P	$35	50	90
Unknown	.. ..	.....	.....	0	0	0	0	.....	.....	.....	35	M	None	95	95
700	352	422	.....	.....	.....	.....	.....	.....	.....	.....	45	.....	.....	80	80
60	40	200	5	90	3	45	60	60¢	.....	.....	45	M	$30	50	80
72	29	384	3	384	3	100	100	20¢	20¢	M	58	M	None	70	70
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	52	M	.....	.....	.....
.....	.....	150	.....	0	0	0	0	.....	.....	.....	19	M	None	65	65
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5	M	.....	.....	45
.....	.....	365	2	365	2	100	100	24¢	15¢	H	47	M	.....	90	90
3	5	55	.....	.....	.....	.....	.....	.....	.....	.....	3	P	None	.....	.....
Unknown	.....	200	4	1	.....	.....	.....	.....	.....	MH	34	M	None	75	100
375	76	1,654	.....	1,654	71	100	.....	30¢	12¢	H	115	M	None	120	150
Unknown	.....	368	7	368	7	100	100	48¢	27¢	PH	56	M	None	75	88
Unknown	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	36	M	None	45	45
.....	.....	400	29	0	29	0	100	.....	30¢	P	38	M	$44.75	75	130
3	5	133	7	0	0	0	0	.....	.....	.....	22	M	None	98	.....
.....	.....	75	.....	.....	.....	.....	.....	.....	.....	.....	37	M	.....	65	100
200	91	440	2	440	2	100	100	25¢	25¢	M	62	M	.....	40	126
5	2	179	.....	175	.....	98	.....	45¢	.....	M	32	M	None	85	85
200	67	1,600	.....	1,600	.....	100	.....	50¢	.....	H	200	M	None	60	60
117	2	1,300	16	.....	.....	.....	.....	.....	.....	.....	116	P	None	60	85
.....	.....	450	.....	.....	.....	.....	.....	.....	.....	.....	34	.....	.....	70	100
1,000	470	400	4	0	5	0	100	.....	5¢	M	74	M	$21	63	63
.....	.....	175	1	135	0	77	.....	40¢	Free	M	40	M	.....	81	81
175	63	540	.....	540	.....	100	.....	50¢	50¢	P	92	P	$40	85	85
25	15	195	2	0	0	0	0	.....	.....	.....	34	M	$17	80	80
.....	.....	350	4	None	4	.....	100	25¢	7¢	H	32	P	$16	60	60
100	33	600	.....	600	.....	100	.....	40¢	.....	M	104	M	$14.40	70	80
Unknown	.....	150	.....	0	.....	0	.....	.....	.....	.....	35	M	.....	130	130
600	366	325	.....	175	.....	54	.....	50¢	.....	H	67	M	None	65	80
.....	.....	130	.....	100	.....	77	.....	25¢	.....	P	22	P	$15	110	108
300	122	750	13	625	16	98	100	13¢	3¢	M	70	M	$30	110	110
.....	.....	1,003	7	458	7	46	100	25¢	5¢	H	105	M	.....	108	108
.....	.....	70	.....	.....	.....	.....	.....	.....	.....	.....	51	.....	.....	.....	80
.....	.....	.....	.....	225	.....	.....	.....	34¢	.....	.....	45	M	.....	35	93
50	41	366	3	363	3	100	100	18¢	18¢	H	43	M	$30	64	64
.....	.....	550	.....	0	12	.....	.....	.....	6¢	M	59	M	$100	90	90
.....	.....	216	6	216	8	100	100	20¢	10¢	M	42	M	.....	75	75
350	206	600	20	50	.....	8	.....	25¢	25¢	M	43	M	$35	70	70
60	40	300	3	350	3	97	100	30¢	15¢	M	60	M	None	65	65
300	86	360	1	360	.....	100	.....	.....	60¢	P	137	P	$30	55	110

1. *Showing the Barber-Greene reversible spoil conveyor. It delivers to either side, and can be regulated to deposit at various distances from the edge of the trench.*

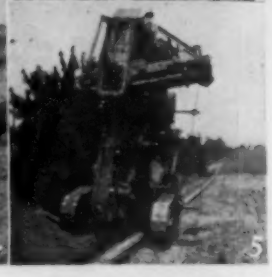
2. *The Barber-Greene vertical boom digs straight down. It leaves but a minimum of unopened trench when digging up to buildings, or obstructions. It eliminates practically all hand labor on service laterals.*

Notice the full length crawler traction that permits the Barber-Greene to cross soft spots, ditches and to turn around in practically its own length. It's another reason why the Barber-Greene is so exceptionally easy to handle.

3. *This overload release sprocket guards the ditcher from the shocks of encountering hidden obstructions. It works automatically, and makes the Barber-Greene as careful as human hands in digging around buried pipe.*

5. *The Barber-Greene special pipe line model for cross country pipe riding work. Except for additional clearances this machine is practically the same as standard ditcher.*

4. *A Barber-Greene taking a grade on a Texas trenching job. The vertical boom holds remarkably close to grade even under such adverse conditions.*



Another Reason Why Pick and Shovel Digging is Going

The cost sheets on a Barber-Greene Ditcher, working near San Angelo, Texas, show a total charge of $548.25 for sixteen miles of ditch. This figure includes all items, such as maintenance, repairs, operating costs and operator's wages, but does not include overhead nor depreciation.

This total brings the actual per lineal foot cost on the sixteen miles of digging to 648/1000 of a cent. Hand labor does exceptionally well if it can even approach three times this figure.

In addition, the compactness of the Barber-Greene combined with the high speed vertical digging boom and full length crawlers permits it to dig in crowded quarters—to dodge trees, poles, buildings and similar obstructions with but little lost time and little lost ditch—to cross gullies and ditches without fill ins—to be taken out of its garage for short runs—to handle such town and city jobs as service laterals and pipe recovery.

Small wonder that pick and shovel digging is going into the discard—and Barber-Greenes are replacing it.

For more detailed information on the Barber-Greene Ditcher, both the regular and pipe line model check the coupon at the top of the page. It will bring you the latest Barber-Greene Ditcher job booklet, "Cutting Mains and Services," and the paper which A. G. Ford of the Western United Gas and Electric Company read before the 21st convention of Illinois Gas Companies.

They're free to those interested. Send the coupon for them. We'll see that you get a copy of each.

BARBER-GREENE COMPANY—*Representatives in Fifty Cities*—515 W. Park Ave., Aurora, Ill.

BARBER GREENE

Portable Belt Conveyors — Self Feeding Bucket Loaders

Coal Loaders . Automatic Ditch Diggers . Snow Loaders . . . . Coal Feeders

Chamber of Commerce Activities in Public Affairs

The Tampa Board of Trade Building

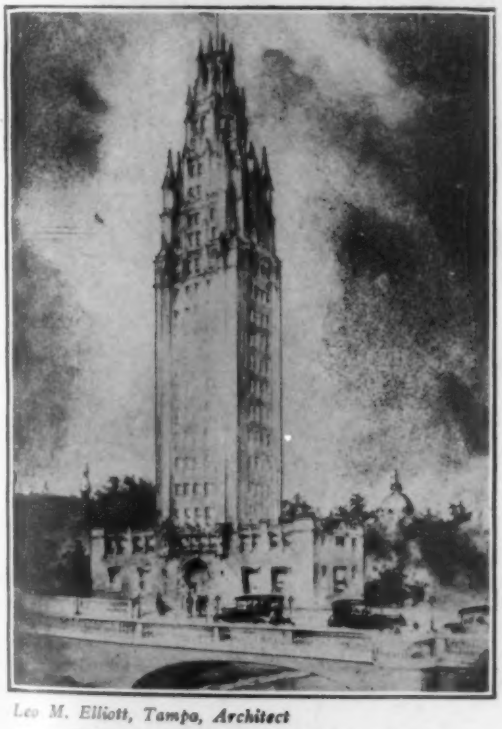
TAMPA, FLA.—At a special election held March 17, the people of Tampa approved the conveyance of property in Plant Park to the Board of Trade to be used for the site of a Board of Trade Building which will surpass in architectural beauty and individuality any building of this kind in the South.

The site is the southeast corner of the park, facing 120 feet on Lafayette Street at the termination of the Lafayette Bridge and 60 feet in depth. Plant Park, one of the finest sub-tropical parks in the world, is owned by the city of Tampa. In it are located the Tampa Bay Hotel, the Tampa Bay Casino Bandshell, also a building used by the women's clubs, tennis courts, and grounds for various tourist games. The new building will occupy a portion of the grounds not well adapted to other purposes. A unique feature will be that the building will extend for a short distance over the Hillsborough River, and boat-houses will be included in the construction. A portion of the floor below the street will be used for commodious rest roms, which are needed in the park.

The main part of the building will be two stories in height and will cover a space of 120 by 45 feet. The first floor will be set aside for rooms for the reception and entertainment of visitors to the city and for the activities of the state clubs, and the second floor will be occupied by the executive departments of the Board of Trade. The main tower of the building will be thirteen stories high and will be 45 feet square. Twelve stories will be occupied by offices of professional men. If it is decided to make the building a medical headquarters, an emergency ward and operating room and X-ray studio will be equipped for the use of the doctors. On the top floor will be a dining-room and a kitchen for luncheons and banquets. The spire of the tower will be offered to the Tampa Weather Bureau for observation purposes.

The land for the building is being conveyed to the Board of Trade with the provision that the building be erected and after a period of thirty years returned to the city, which will, of course, allow the Board of Trade to retain quarters there permanently. Arrangements have been made for the financing of the enterprise, and bonds will be issued against the building for its construction. At the end of the thirty years it should have paid for itself.

L. P. DICKIE,
Managing Secretary, Tampa Board of Trade.



Leo M. Elliott, Tampa, Architect

TAMPA BOARD OF TRADE BUILDING

Elberton Offers Five-Year Exemption from Taxation

ELBERTON, GA.—This city is the first in Georgia to act under the constitutional amendment approved last November, which makes it possible for municipalities and counties of Georgia to exempt certain manufacturers from local taxation (except on land) for a period of five years. This amendment provides that:

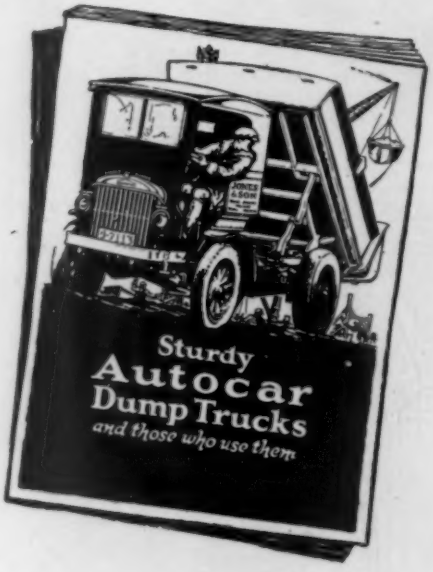
"Any person, natural or artificial, a resident of this state, who may after January 1, 1924, build, equip, establish or enlarge a plan for the manufacture or processing of cotton, wool, linen, silk, rubber, clay, wood, metal, metallic or non-metallic mineral or combination of same, creamery or cheese plant; or for the production or development of electricity may, as to such building, enlargement, or equipment, be exempt from all county, incorporated town or city ad valorem taxes for a period of time not exceeding five (5) years from the date of the beginning of the building, enlargement or equipment of such plants. The Legislature is herewith empowered to make provisions for the operation of this paragraph by appropriate legislation, provided such exemptions shall be approved by a majority of the electors voting in such county, incorporated town or city proposing said exemption."

Anticipating a favorable vote on the amendment last fall, the Elberton Chamber of Commerce had previously cooperated with Dr. A. S. J. Stovall, Representative from Elbert County, in securing the adoption of enabling acts by the 1924 Legislature, under which Elbert County and the city of Elberton adopted the tax-exemption plan at a local election

Every user of dump trucks who reads this new 60 page illustrated book will learn so much about economy in dump truck hauling that his next truck will be an

Autocar

Send for your free copy!



The Autocar Company
Ardmore, Pa.
P. O. Box 2010

Please send my copy of the Autocar Dump Truck book.

Name.....

Street.....

City.....

The Autocar Company
ESTABLISHED 1897
Ardmore, Pa.
Branches in 46 cities

Autocar

wherever there are roads to build

in January, 1925. Enabling acts for other cities and counties cannot be passed until the Legislature meets again in June.

In a circular addressed to prospective industries, the Elberton Chamber of Commerce is now able to say:

"Cast your lot with us, and we will make the initial five-year period of your existence here (while you are becoming strongly entrenched) easy for you by waiving the payment of city and county taxes."

THOMAS H. COOLEY,
Secretary, Elberton Chamber of Commerce.

City's Tax Budget Analyzed

MINNEAPOLIS, MINN.—Each week during the first quarter of 1925, a "Tax Primer" in serial form has been a feature of *The Minneapolitan*, the bulletin of the Minneapolis Civic and Commerce Association. The series was prepared by the Bureau of Municipal Research of the Association, with the idea that a clear and concise analysis of the city's tax budget would be welcomed by the people of Minneapolis.

Much interest has been expressed in this "Tax Primer," not only among the Association's members and local taxpayers generally, but by organizations and publications in various parts of the United States.

C. M. ARTHUR,
Assistant Secretary, Minneapolis Civic and Commerce Association.

The Tax Primer

The taxpayer of today wants to know what he gets for his tax dollar. The Tax Primer, designed by the Association's Bureau of Municipal Research, will illustrate in a simple fashion how the Minneapolis tax dollar is divided.

Parks and playgrounds
will be allotted
3.5 cents
of each Tax Dollar

Under this distribution there will be:

$570.142 for the Park Board and the Council to spend out of taxes only.

To maintain:

1. 130 parks containing 4,569 acres.
2. 55 miles of parkways and drives known as the "Grand rounds, for which the city received $46,387 in fees.
3. 300 miles of street trees.

To conduct:

1. 29 playgrounds in all sections of the city used by 880,000 persons last year.
2. 2 18-hole golf courses on which were played 126,000 rounds, for which the city received $46,387 in fees
3. 3 bathing beaches supervised by the Park Board and used by 550,000 in 1924 and 1 beach and 2 bath houses supervised by the Council for all of which $14,202 in fees were paid.
4. 32 skating rinks patronized by 965,600 persons last year
5. 1 iced racing course on the Lake of the Isles.
6. 150 musical concerts, attended by more than 300,000 persons in 16 parks.
7. Canoeing and boating facilities on 3 lakes, netting last year a revenue of $23,107 including $6,000 profit.
8. 14 picnic grounds with all necessary facilities.
9. 1 nationally known tourist camp in Minnehaha Park visited last year by 4,640 cars carrying 14,472 persons from 46 states other than Minnesota.
10. 8 refectory stands doing a business of $135,000 and showing a profit of $15,000 above running expenses

The salaries and wages of from 200 to 700 persons engaged by the Park Board and by Council amount to $431,552, the number employed varying according to the season.

NO. 2 OF A SERIES

The Tax Primer

Two of the outstanding services that taxes provide are the protection of lives and property of citizens through the departments of Fire and Police, both of which in Minneapolis are highly efficient. This week's Tax Primer shows the division of the tax dollar for those purposes

The Fire Department
will be allotted
6 cents
of each Tax Dollar

This will produce $958,600 in taxes which, with $275,100 from other sources will be used by the department

TO MAINTAIN 29 stations, housing $790,000 worth of motorized equipment to protect the lives and property of Minneapolis citizens. Property loss in 1924 amounted to $2,000,000.

TO PAY $1,135, 240 in salaries to 531 men, including

1 chief and 13 assistants	111 fire engineers, operators
8 captains	and drivers
42 lieutenants	267 fire fighters
49 other employees	

TO PURCHASE hose, fuel, gasoline, oil, and other supplies and to keep in repair the buildings and equipment.

With similar tax money, the department in 1924
Used 40 pieces of apparatus, to respond to 4,700 fire calls.
Used an estimated 14,350,000 gallons of water in extinguishing fires.
Maintained a machine shop in which more than 20 pieces of motor apparatus were built and placed in service

The Police Department
will be allotted
5.3 cents
of each Tax Dollar

This will produce:
$858,155 in TAXES to which will be added $246,300 as the Department's share of revenue from other sources.

Out of this money, the department must
MAINTAIN 6 stations in different parts of the city.

1 chief	9 lieutenants
1 assistant	37 detectives
9 captains	398 sergeants and patrolmen
45 other employees	

the total salary bill amounting to $1,007,000 in 1924
PAY the upkeep of stations, cars and motorcycles, and similar expenses in the sum of $86,400.

For the taxpayers' money the department last year rendered these services:
Patrolled the city at night with automobile shotgun squads.
Handled vehicular traffic at 21 corners.
Made 52,736 arrests resulting in 20,385 convictions and fines of $125,185 imposed by the court.
Restored to their owners 835 of 905 stolen cars.

NO. 3 OF A SERIES

Important Public Improvements in Omaha

OMAHA, NEBR.—More than $23,000,000 will be spent in Omaha this year for building, city improvements, and public utilities construction. Of this amount $13,350,000 will be spent for new homes, schools, churches, hospitals, and clubs, and of the remainder, $10,400,000 for industrial, commercial and civic enterprises. This will make 1925 Omaha's banner building year.

The school building program, which totals $2,750,000 for 1925, is an effort to catch up with the need for school housing facilities and to eliminate present congestion in several of the 61 public grade and high schools. This program follows one totaling $5,000,000 spent in the last three years and completed last fall, when a high school costing $750,000 was opened for use. A technical high school costing

Good Value

You measure the value of a machine chiefly by the satisfaction it gives, the time and money it saves, the length of its service. Judged by any standard of satisfactory performance and economy, the "Caterpillar" is *good value.*

In public works of every kind, where power plus traction is needed, the "Caterpillar" has proved itself a faithful public servant; in road building and maintenance, earth moving, and municipal hauling tasks.

Many contractors, public officials, and engineers who have kept close watch of costs say their "Caterpillars" have paid for themselves in one year's time or less, and good for more years to come; just by getting work done well, quickly, cheaply.

We have facts and figures of interest to communities of every size. Write for our illustrated literature.

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PEORIA, ILLINOIS **STOCKTON, CALIF.**

***Export Division:* 250 W. 54th Street, New York.**

CATERPILLAR
Reg.U.S. Pat.Off.

When writing to Advertisers please mention THE AMERICAN CITY—Thank you.

$3,500,000, opened for use two years ago, was included in that program. In the present building plans, two high schools, each to cost about $600,000, and several grade schools will be built or enlarged.

Paving to be laid in Omaha this year will cost $1,250,000. New sewer-mains will exceed $750,000 in cost. Twenty miles of gas-mains and thirty miles of water-mains are to be laid by the Metropolitan Utilities district at an estimated cost of $500,000. Boulevard paving, swimming pools, and other park improvements will add another $100,000 to the cost of city improvements in 1925, and $41,000 has been appropriated to dredge and deepen Carter lake, Omaha's largest aquatic summer resort.

Public utilities improvements for 1925, excluding water and gas service, which are municipally-owned, include the completion of the $4,000,000 building and extension program of the Nebraska Power Company, of which $1,000,000 will be spent this year, and an additional $1,785,000 appropriated for the company's extension and replacement program. The Northwestern Bell Telephone Company, which maintains its headquarters for seven states in Omaha, will spend $950,000 for additions and replacements.

CLARKE G. POWELL,
Commissioner, Omaha Chamber of Commerce.

"Contributions—How to Give and How to Get"

SYRACUSE, N. Y.—The most popular activity which the Syracuse Chamber of Commerce has ever undertaken was the recent publication of a pamphlet, "Contributions—How to Give and How to Get." We are really indebted to the Cleveland Chamber of Commerce for the idea, and our pamphlet is practically a reprint of the one published in Cleveland, with changes necessary to adapt it to local conditions.

The pamphlet is in the form of a report of the Chamber's Committee on Solicitations, its scope being indicated by the following section headings:

Policy and Service
Methods of Testing Cases
Appeal Characteristics
Philanthropic Solicitations
"Benefit" Performances
The Church Bazaar
Patrons and Patronesses
Tag Days
Souvenir Programs and Year Books
Special Editions
Questionable Practices
Ex-Service Men's Welfare Organizations
Fraudulent Soliciting Schemes
Solicitations—Questionnaire

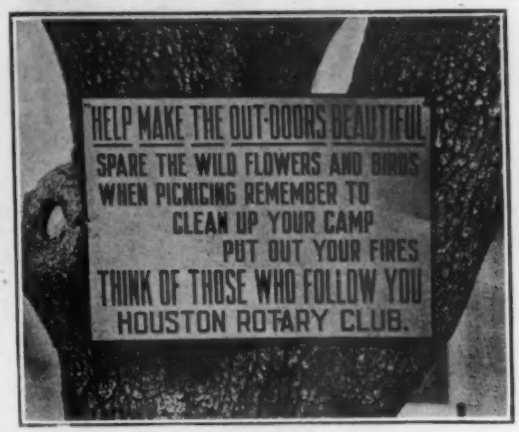
Perhaps no other work which we have conducted has brought forth from the membership, especially the substantial men of the city, so many letters of approval.

FREDERICK E. NORTON, Secretary.
Syracuse Chamber of Commerce.

Rotary Club Appeals to Picnickers

HOUSTON, TEX.—An appeal to tourists, picnickers, and others who stop to enjoy the parks and picnic spots in this city and county, to help preserve the beauty of the outdoors for those who may follow them, has been made by the Houston Rotary Club.

Having witnessed the fine results attained by the use of such signs as "Spare the Flowers" and "Put Out Your Fires" along the mountain trails of the National Parks and elsewhere, the writer proposed that the Rotary


HELP MAKE THE OUT-DOORS BEAUTIFUL
SPARE THE WILD FLOWERS AND BIRDS
WHEN PICNICING REMEMBER TO
CLEAN UP YOUR CAMP
PUT OUT YOUR FIRES
THINK OF THOSE WHO FOLLOW YOU
HOUSTON ROTARY CLUB.

HOUSTON ROTARY CLUB TEACHES THE PUBLIC TO THINK
(But apparently they go picnicking without a "k" in Houston)

Club take the initiative in carrying out the same idea in the parks and other wooded sections of this vicinity. Acting on this suggestion, the Club placed an order for 250 signs of the type shown in the accompanying illustration. These were distributed not only in the parks but also in the lobbies of the public schools, at gasoline filling stations, and other public places where it was thought they might be effective.

By an arrangement with the street car company, placards bearing the wording of the sign were placed in all street cars in the city for a period of two weeks, and in this way, with the additional help of the publicity which the local press willingly gave to the idea, the message was brought before all people in the community.

C. B. QUARLES

For dates of the National and Western Summer Schools for Chamber of Commerce Secretaries, see convention calendar, page 599.

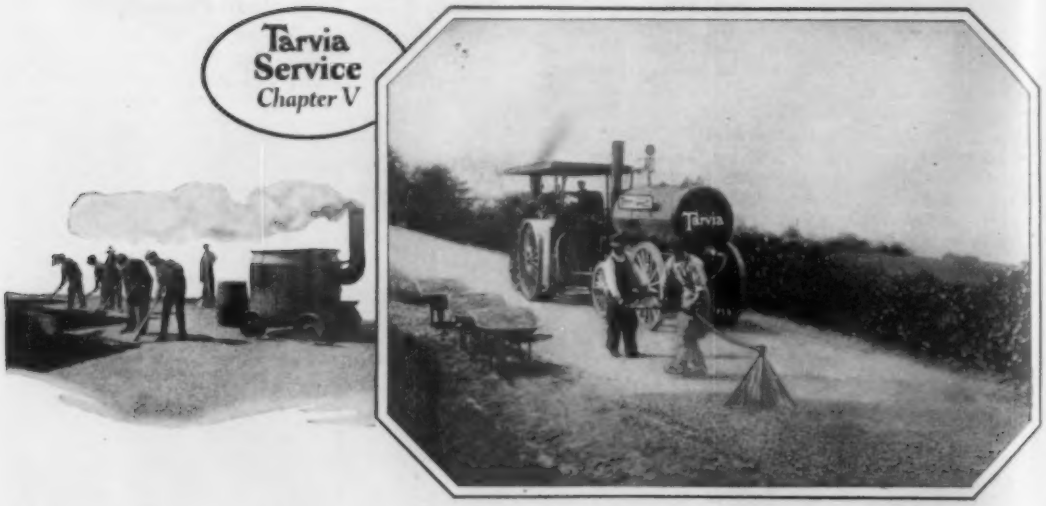
Londoners Live 20 Years Longer Than Their Grandparents

CITIZENS of the British metropolis have reason to congratulate themselves on the improvement in public health conditions in London during the last 80 years. as disclosed by the annual report of the London County Council for 1923. The graphs herewith reproduced from this report show a notable decrease in death-rates, and a corresponding increase in expectation of life. According to the report, a baby born in London in 1920-22 had an expectation of life, if a boy, of 53.8 years, as compared with 34.6 years in 1841-50; and if a girl, 59.1 years as compared with 38.3 years. In the course of 80 years, therefore, the average Londoner's lifetime has been extended by more than 20 years.

New records were established in 1923; the death-rate that year being 11.4 per thousand; and the infant mortality rate being only 61 per thousand births, as compared wtih 75 the preceding year, which itself was a record rate for London.

The population of London County at the census of 1921 was 4,484,523.

Tarvia Service *Chapter V*



Big economy for little jobs— with Tarvia tank-wagons

AT times the job doesn't justify the faster distribution by Tarvia tank-trucks. For instance—

In communities where it is necessary to do street work, a block at a time—or where interruption of the work is unavoidable—Tarvia tank-wagons are the logical solution. It's an economical thing to keep a Tarvia tank-wagon on the job until the job's done. The cost of renting one of these wagons for the duration of the job is negligible.

And like the Tarvia tank-truck, these tank-wagons are equipped with the patented Barrett nozzle which insures the uniform, unbroken distribution of the Tarvia on the road.

Tarvia tank-wagons stand as another example of Barrett service policy—a *right* Tarvia service for every type or size of job.

The Barrett Company

New York	Chicago	Philadelphia	Boston
St. Louis	Cleveland	Cincinnati	Pittsburgh
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Minneapolis	Salt Lake City	Bethlehem	Lebanon
Youngstown	Milwaukee	Toledo	Columbus
Baltimore	Syracuse	New Orleans	Rochester
Providence			Buffalo

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THE BARRETT COMPANY, Limited

Montreal	Toronto	St. John, N. B.
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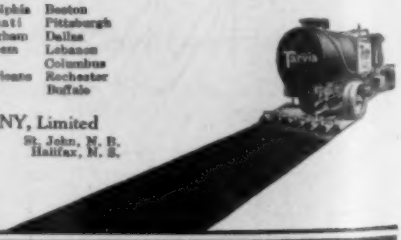
Tarvia

For Road Construction Repair and Maintenance



Architects Association Prepares Civic Center Plan

By S. P. Trood
Allied Architects Association of Los Angeles

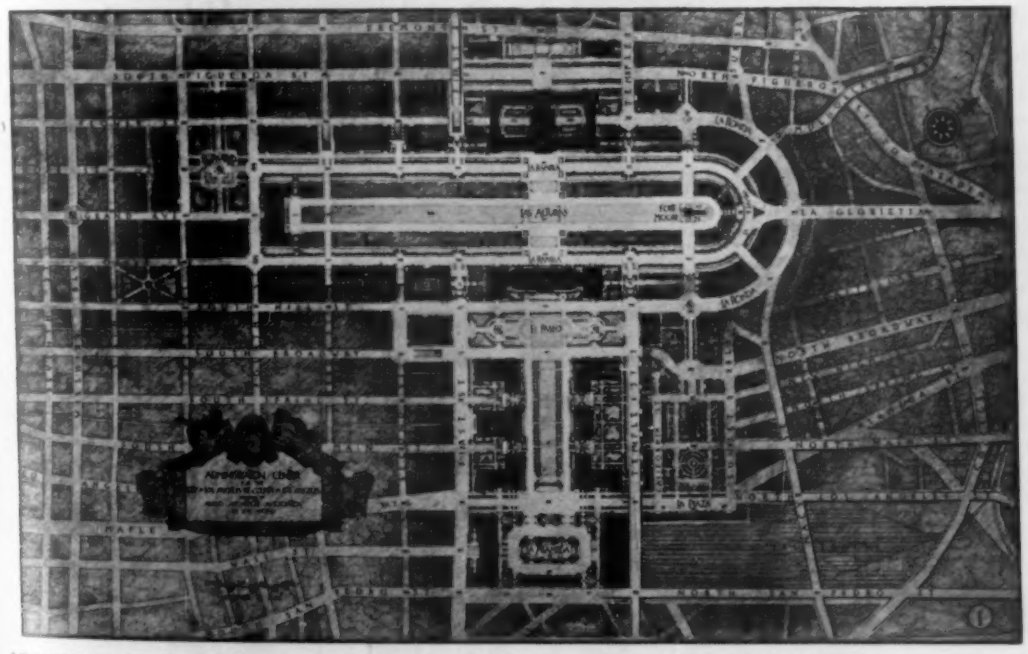
LOS ANGELES, which has lagged far behind many other American cities in the development of an adequate civic center, has finally awakened to her deficiencies in this respect. About a year ago city and county officials authorized the Allied Architects Association to prepare plans, which have recently been submitted and which will, if adopted, metamorphose one of the eyesores of down-town Los Angeles into a beautiful park, while creating in an easily accessible location an adequate grouping of the various governmental buildings in fit surroundings.

Under these plans, Los Angeles will emerge from her renaissance period with public architecture unsurpassed by similar achievements of other great world cities, both here and abroad, possessing a Civic Center appealing alike to the artistic sense of the beauty-lover as a charm spot, and to the utilitarian sense of the most exacting mind as a means of traffic alleviation.

Relieving Traffic Congestion

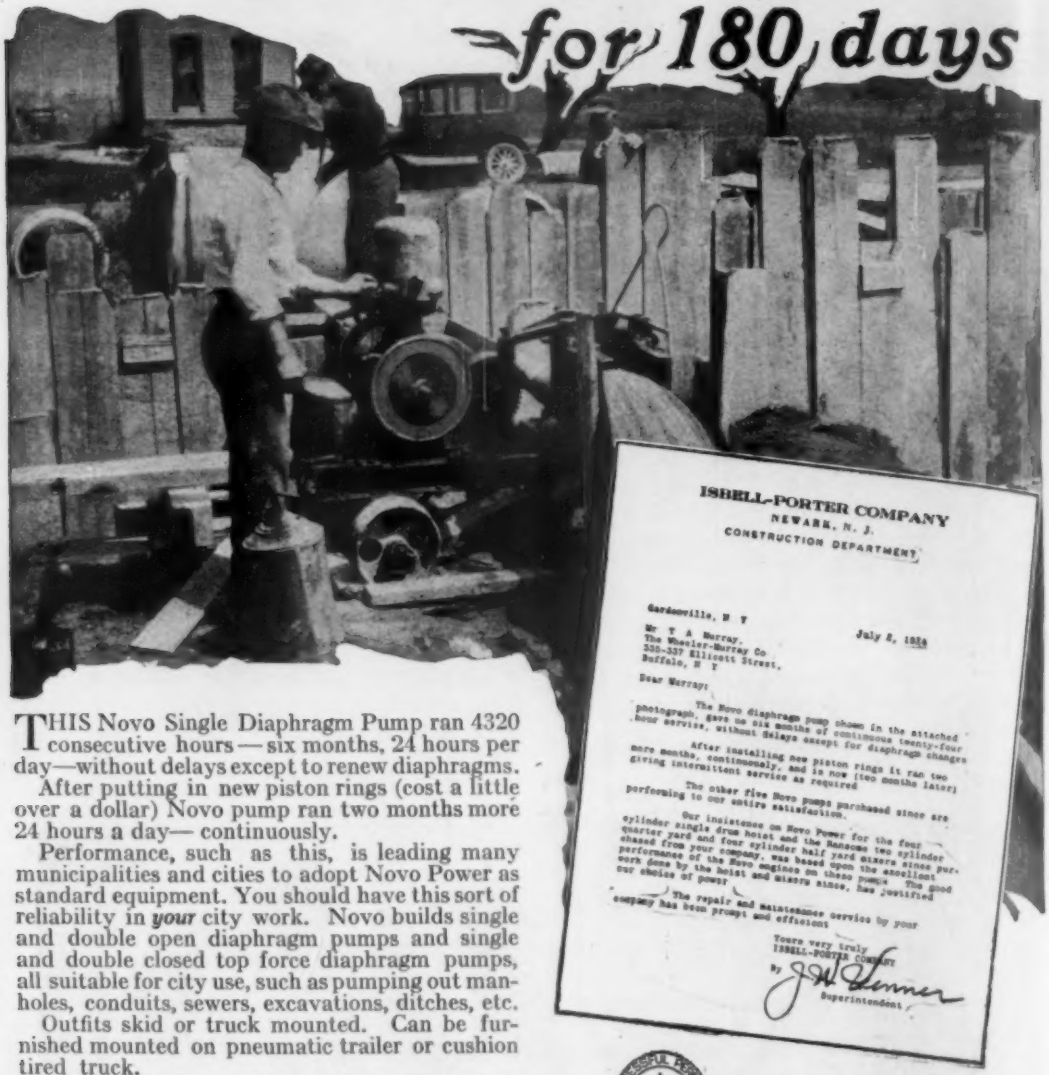
Bunker Hill, which has long been the despair of the business section—an area composed of dilapidated houses in dire danger of becoming a slum district, and comprising a distinct fire hazard—would be transformed into a charming park, encircled by broad boulevards relieving down-town traffic congestion and giving direct access to the densely populated country lying east and north of town, and surmounted with a great Mall, nearly a mile in length, fringed with sites for future buildings of a cultural and semi-public nature. Heavy traffic is to be diverted through great modern, well-aired and well-ventilated tunnels, tending to accelerate rather than to retard traffic speed. As outlined by the Association, the creation of such a park on this great earth mass which has long acted as a traffic barrier is a comparatively simple and inexpensive engineering problem, involving only a process of cutting and filling, while the easy grades specified in the plans would be accomplished at the same time. Los Angeles has been woefully lacking in such parks as would be provided by this treatment of Bunker Hill.

Extending eastward from this park to Los



ADMINISTRATION CENTER PLAN, PREPARED BY THE ALLIED ARCHITECTS ASSOCIATION OF LOS ANGELES

24 hours per day for 180 days



ISBELL-PORTER COMPANY
NEWARK, N. J.
CONSTRUCTION DEPARTMENT

Gardenville, N Y

July 2, 1914

Mr. T A Murray,
The Wheeler-Murray Co.
535-537 Ellicott Street,
Buffalo, N Y

Dear Murray:

The Novo diaphragm pump shown in the attached photograph, gave us six months of continuous twenty-four hour service, without delays except for diaphragm changes.

After installing new piston rings it ran two more months, continuously, and is now (two months later) giving intermittent service as required.

The other five Novo pumps purchased since are performing to our entire satisfaction.

Our insistence on Novo Power for the four cylinder single drum hoist and the Ransome two cylinder quarter yard and four cylinder half yard mixers since purchased from your company, was based upon the excellent performance of the Novo engines on these pumps. The good work done by the hoist and mixers since, has justified our choice of power.

The repair and maintenance service by your company has been prompt and efficient.

Yours very truly
ISBELL-PORTER COMPANY
By J H Penner
Superintendent

THIS Novo Single Diaphragm Pump ran 4320 consecutive hours — six months, 24 hours per day—without delays except to renew diaphragms.

After putting in new piston rings (cost a little over a dollar) Novo pump ran two months more 24 hours a day— continuously.

Performance, such as this, is leading many municipalities and cities to adopt Novo Power as standard equipment. You should have this sort of reliability in *your* city work. Novo builds single and double open diaphragm pumps and single and double closed top force diaphragm pumps, all suitable for city use, such as pumping out manholes, conduits, sewers, excavations, ditches, etc.

Outfits skid or truck mounted. Can be furnished mounted on pneumatic trailer or cushion tired truck.

All diaphragm pumping outfits powered with the reliable Novo single cylinder frost-proof gasoline engine.

Novo service is world-wide. Spare parts can be obtained for any Novo Engine or Outfit, no matter how old it may be. Sixty-five distributors throughout the United States carry the Novo line and give service. Your request for information will be attended to promptly.

NOVO ENGINE CO.
Clarence E. Bement, Vice-Pres. & Gen. Mgr.
LANSING — MICHIGAN
Cable Address "NOVO LANSING"
Distributors Throughout the World

NOVO POWER
Keeps Operations Moving

When writing to Advertisers please mention THE AMERICAN CITY—Thank you.

Angeles Street, a distance of some five blocks, and bounded on the north and south by Temple and First Streets, will be the Administration Center proper, where the administrative buildings of city, county, state, and national governments will be housed in a setting of flowers and greenery fronting on a great plaza. The three great traffic arteries running through the Administration Center—Broadway, Spring, and Main Streets—will be depressed under the plaza; or rather, on account of its location on a low earth ridge, it will be more a case of raised plaza than of intensive tunneling. These traffic passages will be developed along much the same lines as the tunnels under Bunker Hill, providing plenty of ventilation and good lighting, and will have the added advantage of providing parking space both above and below ground. Traffic progress will be greatly increased by this street depression, and the governmental employees will be enabled to carry on their work with increased efficiency, unharassed by the tumult of the busy streets of a great city. In order that ample space may be provided for the present and future housing needs in these buildings, the plans call for structures of the monumental type.

Preserving the Best of the Old

The two remaining relics of the days of the Dons in Los Angeles—the old plaza and Mission Church—will be preserved under the plans of the Allied Architects, which leaves both landmarks unchanged, but which beautifies their surroundings, the church becoming the dominating feature of a small park. Present buildings fronting on the plaza would be razed and the structures replacing them would be built on the low order typical of the Spanish era. This sympathetic treatment, combined with the Old World atmosphere still prevalent in this section, will readily recall to visitors and residents alike a picturization of the plaza as it was in the days when Spanish caballero and Franciscan Father ruled the land, paying homage to the Viceroy at Mexico City. The restoration of the plaza will be a great stride toward the preservation of Los Angeles' traditional and legendary lore.

East of the Administration Center, extending to San Pedro Street, and confined within the same north and south boundaries as the latter, the plans have provided a tentative unit for a Terminal Station and plaza to be used if the Union Station idea ever becomes reality. If the project is abandoned, however, this unit would be discarded and the Civic Center would be closed by the erection of a large building at Los Angeles Street.

Gradual Development Contemplated

One of the many important features of these plans is the grouping of the entire Civic Center in a series of independent units, each capable of either gradual or separate development. The work is so laid out as to enable the public officials to undertake the work in sections, buildings to be erected as their immediate need becomes imperative and as funds become available. At no time would this work become a burden on the shoulders of the taxpayer, since the costs would be distributed over a period of years. The plans were drawn up by the Allied Architects Association after eleven months of intensive study and consultation, following a contract from the Board of Supervisors and the City Council under which the Association was to receive the nominal sum of one dollar for its labor.

General Regional Planning Law Signed for New York State

GOVERNOR SMITH signed last month a bill permitting the establishment of regional planning boards by any county or counties and the cities, towns and villages of any county or counties in New York State. This bill, introduced by Senator Williams, was sponsored by the State Commission of Housing and Regional Planning.

The function of these boards will be to study the needs and conditions of regional and community planning and zoning in such county or counties. The communities are authorized to raise the necessary funds for this purpose by taxation. The members of the boards will serve without compensation.

The General Regional Planning Law, as the law is called, is of immediate interest to the Capital District Region, where the creation of a port district brought to the front the question of comprehensive planning in this region. To anticipate and prepare for the expected growth of the district in commerce, manufacturing and population, an unofficial regional planning organization embracing all the municipalities within the counties of Albany, Schenectady, and Rensselaer was formed recently with the aid and cooperation of the State Commission of Housing and Regional Planning. The Chairman of the Capital District Planning Association is Mayor Hackett of Albany.

"The General Regional Planning Law," said Clarence S. Stein, Chairman of the Commission of Housing and Regional Planning, "will stimulate the development of regional planning boards in the state. In this development New York State is rapidly taking a leading position."

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Double-Traction Tires are built extra size and of high profile, assuring long mileage with good cushioning for your truck. They will materially reduce your trucking costs.

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DOUBLE-TRACTION

AMERICANS SHOULD PRODUCE THEIR OWN RUBBER .. H. S. Firestone

Now Ready: The Second Annual Edition of The Municipal Index

THE remarkably cordial reception given last year to the publication by THE AMERICAN CITY MAGAZINE of the first edition of an American municipal yearbook has made possible a still larger and more valuable volume this year. This 1925 edition of THE MUNICIPAL INDEX, a bound volume of more than 500 pages, has a fourfold value:

1.—As a *Yearbook:*

An important function of THE MUNICIPAL INDEX is to record the progress of the preceding year in municipal government and administration, and in allied movements of importance to forward-looking officials, educators and civic organizations. The yearbook features of the 1925 volume include:

Municipal Progress in 1924
Costs of City Government
Progress of City Planning Law During 1924
Regional Planning—Theory and Progress
The Year 1924 in Community Recreation
Recent Progress in Public Education
Public Libraries and Adult Education
Report of the National Conference on Street and Highway Safety
Water-Works Statistics, covering Source of Supply, Purification Methods, Per Capita Consumption, Metering, etc.

2.—As a *Cyclopedia:*

In many activities of city and county governments the best practice of to-day is not essentially different from that of a year or two years ago—but the need exists for more general knowledge of what that best practice is. To help meet this need, THE MUNICIPAL INDEX for 1925 has authoritative articles on the following subjects:

Collection and Disposal of Garbage, Ashes and Rubbish
Motor Trucks in Municipal Departments
Sewers, Sewerage and Sewage Disposal
Street and Highway Lighting
Street Cleaning and Snow Removal
Street Construction
Power-Plant Equipment and Operation
Some Aspects of Municipal Finance
Codification of Municipal Ordinances
The Proportional Representation Method of Elections
Municipal Pension Systems
Weights and Measures Supervision
Excess Condemnation in Municipal Improvements
Building Codes
Police Administration
Decreasing the Fire Hazard
Increased Efficiency in Fighting Fire
How to Reduce Fire Insurance Rates
The Money Value of Parks and Scenic Beauty
Sanitation of Tourist Camps
Public Control of Street and Roadside Plantings
Public Health
How to Get the Right Public Building
Know Your Public Library
Museums
The Administration of Justice in the Modern City and County
Bases of Rate Making
How Town Planning Saves Cost

3.—As a *Directory:*

In municipal and county affairs, much time and money are lost by too general dependence on the "trial and error method" of getting things done. More wide-spread access to the sources of information and aid, and greater use of the results of experience elsewhere, will save much wasted effort and insure more rapid progress. To this end, THE MUNICIPAL INDEX for 1925 contains directory features which will be found very helpful:

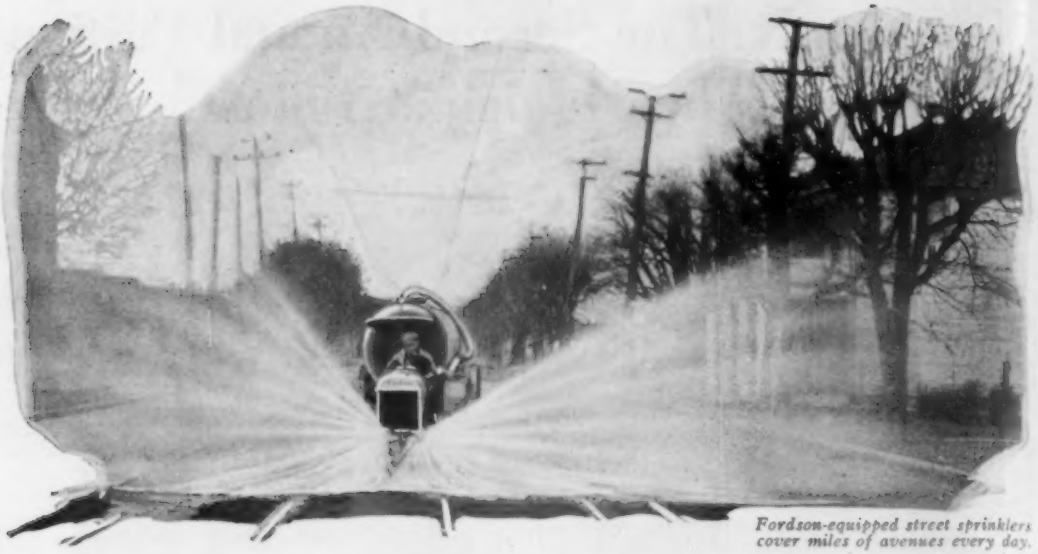
Directory of City Manager Cities
Bureaus of Governmental Research
Municipal Reference Libraries
Zoning Progress in the United States (with complete list of zoned cities)
National Organizations Serving Municipalities and Local Groups
Municipal Aids from Uncle Sam
State and Provincial Leagues of Municipalities
Bibliography of Recent Books and Pamphlets and of Articles in THE AMERICAN CITY MAGAZINE

4.—As a *Catalog:*

In the forward march of American communities of all sizes, the use of the most efficient labor-saving machinery and devices and of up-to-date equipment and appliances in all departments, is of prime importance. Nowhere else is there available under one cover such comprehensive information on things needful in public improvement work as is presented in THE MUNICIPAL INDEX. The 1925 volume contains the condensed catalogs of more than 160 manufacturers and consultants, classified in sections as follows:

Administration—Government—Finance
City and Regional Planning, Housing and Zoning
Fire and Police Departments
Garbage, Ashes and Rubbish—Collection and Disposal
Motor Trucks in Municipal Departments
Parks—Playgrounds—Trees
Power-Plant Equipment and Operation
Public Health—Public Welfare—Public Education—Public and Community Buildings
Public Utility Ownership and Regulation
Sewers, Sewerage and Sewage Disposal
Street and Highway Lighting
Street Cleaning and Snow Removal
Street Construction
Water-Supply Statistics

The Municipal Index for 1925 is a reference work of great practical value to municipal officials, civic organizations, educators, public libraries, and others having to do with municipal and county improvements. Price $4.00 postpaid. Published by The American City Magazine, 443 Fourth Avenue, New York City.



Fordson-equipped street sprinklers cover miles of avenues every day.

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Fordson power gives perfect satisfaction in street sweeping service.

Enthusiastic endorsement follows the installation of Fordson equipment in municipal service and the citizens are led to express their unqualified approval.

The Fordson is creating new standards every day in civic sanitation and the maintenance of public works. In street sprinkling and sweeping, removal of refuse, trimming lawns, clearing snow and general transportation and power purpose, the Fordson quickly pays for itself in the time, labor and money saved.

A demonstration will convince you of the possibilities of Fordson power in your own community. Call for this service from your nearest Authorized Ford Dealer.

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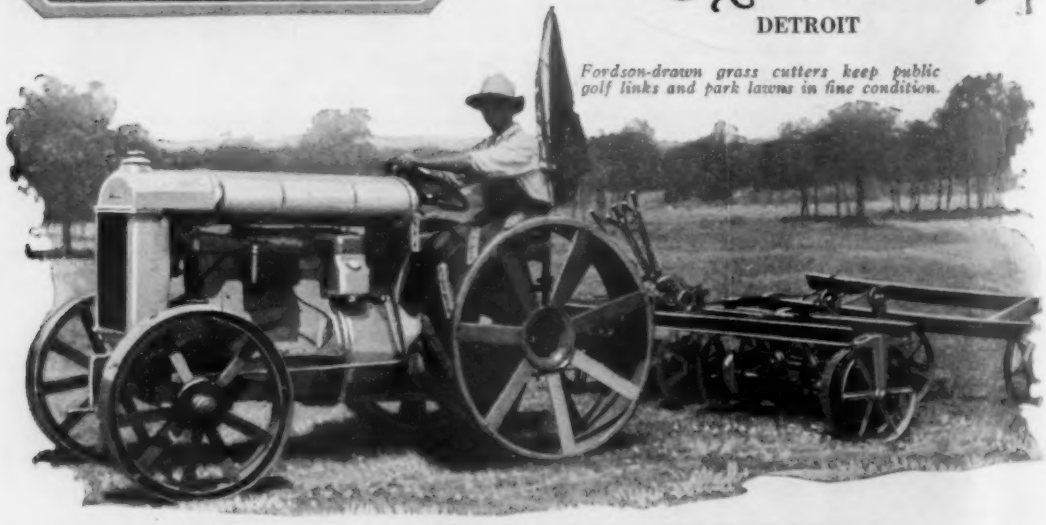


Scientific Management as a Guide in Traffic Planning

By A. G. Straetz, M. E.
Traffic Consultant, Elizabeth, N. J.

TRAFFIC conditions on our streets and highways to-day greatly resemble the confusion and disorder which prevailed in the industrial production field about twenty years ago. An abundant supply of cheap labor with little competition sponsored a condition that was almost disastrous to our economic life.

The science of scientific management as initiated by Taylor and continued by Gantt, Emerson, Gilbreth and others has since revolutionized production in the industrial establishments of the United States and perhaps the world. Its purpose was primarily to eliminate "lost motion" for the benefit of the producer. But this benefit, in its natural way, had to be passed on to the consumer, and to-day the practical application of Taylor's ideas has wrought unforeseen advantages to everybody. It has cheapened production, reduced working hours, hastened distribution and turnover, and, consequently, as a wholesome stimulant has increased wages and profits.

It is my opinion that the present traffic situation is quite analogous to the industrial situation before Taylor's time, and its correction calls for analogous ideas and methods. Here again we find that the big problem is the elimination of "lost motion." As formerly in industry, here is ever-growing waste of human efforts due to a general lack of coordination. Even in its details and in its methods of investigation and correction does it resemble the industrial situation. Time study in industry is similar to the count of traffic to ascertain its amount, direction, speed, etc. The rearrangement of machinery to expedite production must be applied here as a rearrangement of traffic on the thoroughfares of the community by means of re-routing, selecting and distributing. The result, of course, will be cutting of corners, improvement of pavements, widening of roadways, provision of one-way streets, etc.

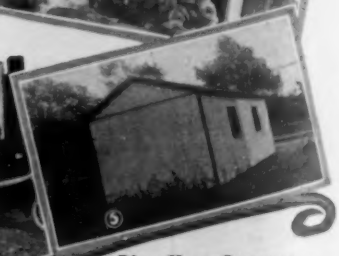
To the tremendous economic waste is added an ever-mounting record of accidents and loss of life. "Lost motion," represented in lost lives, lost man-hours, lost motor-hours, loss of property, reflects the acuteness of the situation. It has been found in industry that coordinated work, order, cleanliness, improved lighting, etc., have greatly reduced the number of industrial accidents, and at once increased production. Some of these experiences applied to traffic will bring similar results. Coordination of vehicular and pedestrian traffic, control of drivers, standardization of signals, improved lighting, re-routing of traffic, regulation of parking, etc., will greatly reduce this loss. And here again, as in industry, many a change may look awkward and artificial, but, if based on scientific principles must produce results.

The application of various signals for the regulation and control of traffic may be compared with guards and fenders on machines, which force the worker to do the one thing which is in his bodily and economic interest. A limitation of motion in the "way of least resistance" must be introduced, and again in the traffic field a happy combination of man and machine will lead the way out of the chaos.

All these limitations, regulations and enforcements may, as in the industrial field, result in a general outcry against new limitations of personal liberty. Time study was considered by many men as an encroachment on personal rights; rearrangements of machinery and other changes were resented by many who had been accustomed to do as they pleased. An early increase in wages and decrease in working time, representing considerable economic benefits, soon brought about a general reconciliation to, and understanding of, the new order.

The industrial situation was considerably aggravated by differences of opinion between the employer and the employee. No such aggravation should be expected through the enforcement of scientific methods for the remedy of traffic conditions. The methods to be applied may vary to a certain extent, but the essential must be the same, just as Taylor's ideas have held and still hold their grip on scientific management in industry. The Taylors, Gantts and Emersons in the scientific management of traffic must be men of similar type and structure, just as thorough, just as practical, and by all means just as forceful.

Scientific management in production made possible the tremendous increase of motor vehicles. Its triumph will be complete if it can put order into the chaos of our highways.



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Thus, engineers and sponsors of public utilities, with confidence born of long experience with Blaw-Knox products, are turning naturally to the economies of Blaw-Knox steel buildings.

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Any type or size can be furnished to your exact specifications—for immediate delivery. Provide Blaw-Knox buildings for (1) road equipment, (2) contractor's buildings, (3 and 4)-material storage, (5) voting booths, and (6) municipal housing requirements. See illustrations.

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Hints, Helps and Happenings

Why Not Wage War on the Weeds?

A VISITOR to a thriving little city was being shown around town on a summer afternoon by the secretary of the chamber of commerce. There were many objects of local pride—the fine high school building, the auto camp site, the big new factory, and many streets of comfortable homes.

But the visitor noticed that his host never called attention to the appearance of the streets, nor of the roadways in the city's new park. The reason was all too obvious—the most conspicuous feature was the mass of weeds and grass between the pavement and the sidewalks of the principal thoroughfares; and on the less-frequented streets and the park roads and paths the weeds were almost everywhere.

This untidy condition of affairs is less common than it was some years ago; but there are still far too many officials and organizations in cities, towns and villages who do not realize the bad impression which a weedy roadway gives to the visitor. And the home folks are worth considering, too, in this matter, for civic pride cannot well flourish where untidiness prevails, to say nothing of the dangers to public health which lurk in many a weed-infested street and lot.*

Instead of a spasmodic weed-elimination campaign, or the old, inefficient method of sending men over the roadways again and again with hoes or scrapers to remove the weeds, there is much to be said for the treatment of roadways and gutters with the available chemical preparations in liquid form, which sink into the ground, destroying all existing growth and having a sterile effect on the soil. By the use of properly designed sprinkling equipment, good results can be obtained with such chemicals on roads or gutters of earth, gravel, ash, brick, cobble, or crushed stone construction; in fact, on any ground where vegetation thrives.

Ban on Whistles in Tampa

ORDERS have been given by City Manager Leslie Brown, of Tampa, Fla., to the superintendent of the water-works to discontinue the blowing of the siren whistle which for years has announced to the city when a fire alarm has been sounded and when a fire has been extinguished. The City Commission regards the blowing of the siren as an unnecessary disturbance to citizens and visitors, since it has not been used to give any signal to the fire department.

Another movement in the direction of banning needless noise has resulted in an interesting legal controversy which was terminated recently in the city police court when two locomotive engineers were fined $10 each for blowing whistles. The two men had been arrested by order of Chief of Police York, as a test case to determine whether or not an ordinance prohibiting the sounding of steam whistles in the city could be enforced. It was said that the ordinance conflicted with state and railroad regulations. It was found, however, that according to the state law the ringing of a bell at crossings is sufficient warning, but that railroad regulations required the blowing of the whistles.

For years several freight engineers have seemed to derive much personal satisfaction from blowing their steam whistles during the night and after sufficient practice have been able to obtain some startling effects. One engineer with a musical turn of mind has been endeavoring to play the once-popular Missouri Waltz on his engine whistle, and no doubt he will regret having to discontinue his practice. Another has used this means regularly, when approaching the city about 5 o'clock, to signal his wife that it was time to put on the breakfast hoe-cake. Now, that the blowing of locomotive whistles has been made punishable by law, in Tampa, the alarm-clock business may increase, but those who get their most satisfying sleep just before dawn may slumber on undisturbed.

Australia's Federal Capital to Be a No-Tax City

EARLY in the inception of the plans for Canberra, Australia's new capital now under construction, a provision was incorporated in the Commonwealth Constitution that the land embracing the Federal Territory should not be permanently alienated, and that the values created by the establishment of the Capital City should be conserved to the people. In accordance with this policy, the first sale of land-leases was held on December 12 last, when 104 business lots and 289 residential lots, on 99 years' leases, were offered by auction. The sale was conducted on Capitol Hill, at the rear of the provisional Parliament House, and the bidding was spirited, an average of £30 per foot being realized. The price merely fixes the capital value. All the purchasers have to pay is a yearly rental of 5 per cent on the amount fixed by the accepted bid. The leases are subject to reappraisement after twenty years, and thereafter periodically. Altogether, 150 leases were sold, of a capital value of £60,000, which will bring the Commonwealth a yearly revenue of £3,000.

In reporting these facts, *Progress*, of Melbourne, says: "The good prices given for these leaseholds negative absolutely the theory that private ownership of land is necessary for settlement. Exception may be taken to reappraisement being delayed for twenty years from now, but, at the prices, this arrangement will probably work out equitably both to the buyers and the community. These prices, obviously, cover considerable anticipatory value. Manifestly £30 per foot is too high a site value now, for land practically in the wilderness, but, as the city develops, it will increase in value year by year. Spread over the full period, the payments should represent, approximately, a fair return to the community, for the community-created values which the leaseholders will enjoy. The authorities estimate that 5,000 people will be residing at Canberra in five years, and 10,000 within ten years."

* See article by Albert A. Hansen, "Danger Lurks in City Weeds," in THE AMERICAN CITY for July, 1924.

People Don't Think Before They Drink

As a rule, people are careless when drinking from "bubblers." Their lips are apt to touch the "bubbler head"—contamination arises and is passed along to others.

This is impossible with the Rundle-Spence Vertico-Slant Sanitary Drinking Fountain because lips can't *touch the nozzle.* People don't think before they drink, but they *must* drink sanitarily from this type of R–S Fountain. The slant stream is situated as to make drinking quick, easy and convenient. For these reasons, R–S Vertico-Slant Fountains are used in parks, playgrounds and other civic places where many people gather.

Everyone interested in city-management should write for the catalog with prices, specifications and complete information on R–S Fountains, Bath and Plumbing Fixtures and Supplies. Your copy is yours for the asking.

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Official Comprehensive City Plan Adopted by Cincinnati

ON April 16 Cincinnati officially adopted a comprehensive city plan, not only for the city, but for the area three miles outside as well. This is the first complete city plan to be officially adopted by any of the larger cities in the country.

This action by the City Council of Cincinnati means that, from now on, there can be no use of private property contrary to the zoning and platting regulations of the plan. It also means that no street or means of circulation, nor public buildings, structures or land, nor public utility, can be located or developed contrary to the plan, unless the plan is amended by a two-thirds vote of the City Council after public hearing, and with the approval of the department affected.

The plan is the result of three years of continuous work on the part of the City Planning Commission and its consultants, the Technical Advisory Corporation. Every city department and every public utility affected by the plan has collaborated in its preparation and concurs in its conclusions.

The program for the carrying out of the plan has been so worked out in detail as to bring no unnecessary burden on the taxpayer. The cost of execution is distributed over fifty years, with no more than a normal proportion of it payable in any one year.

The enterprise is distinctly a citizens' plan, as it was initiated and largely paid for by the United City Planning Commitee, composed of representatives of about thirty of the leading organizations of the city.

To Coordinate New York's Charitable and Social Agencies

THE Welfare Council of New York City came into being on April 2 at the Pennsylvania Hotel, at the fifth annual "Better Times Dinner." As the initial step in the establishment of the Council, a Board of Directors of 73 members was appointed, composed of the heads of various city departments and representatives of the public and of the city's 2,000 private philanthropic and social agencies.

A plan submitted by Robert W. de Forest, chairman of the Coordination Committee, which is responsible for the creation of the Council, sets forth a detailed and scientifically devised program of procedure and provides for the immediate appointment of a staff and the opening of executive offices. The plan is based largely on a study made by W. Frank Persons, former Director of the Charity Organization Society of New York. A fund of $50,000 has been voluntarily contributed for the expenses of the Council for the first two years.

The plan in its essence provides for the further coordination of the work of the city's charitable and social agencies by arranging for their voluntary grouping into certain functional divisions and sections. The Board of Directors, besides promoting conference, understanding, and closer cooperation between kindred groups, will study various social needs and social resources of the city, thus providing the necessary facts upon which the divisions and sections and the Welfare Council as a whole can arrive at well-founded recommendations as to relatively neglected fields, as to duplication of effort, and as to improvement of standards of service and of administration. A study of the feasibility of the Community Chest is foreseen, and other cooperative services are anticipated. The Council will utilize fully all facilities for cooperation now existing.

The Coordination Committee which drafted the plan had been organized by *Better Times*, a non-commercial organ devoted to the interpretation of social welfare work, at the instigation of George J. Hecht, its editor, at the conclusion of its prize contest for plans for the further coordination of charitable and social work in New York City. The five great objectives of the movement are: better factual basis for community planning; better team work among the social agencies; better standards of social work; better public understanding of social work, and better support of social work.

Metropolitan Districts for Michigan

A METROPOLITAN DISTRICT amendment to the state constitution of Michigan has passed both houses of the Legislature with practically unanimous approval. The amendment will be submitted to state-wide vote in November, 1926.

As analyzed by the *Civic Searchlight*, of Detroit, the measure is exceedingly conservative, permitting one or more cities, towns or villages to form mutual partnerships for procuring services such as water, drainage, parks, transportation, etc. The advantage of the plan is to spread the cost of large projects over such communities as receive benefits therefrom. It is strictly an efficiency plan, calculated to save millions of dollars, to permit utmost efficiency by cooperation. It makes no change in political units of government, but authorizes taxation for support of the projects initiated. At every point it is subject to approval by vote of the people affected.

Board of Health Warns Against Dangerous Rat-Killers

THE only standard, approved methods of rat eradication, says the *Weekly Bulletin* of the California State Board of Health are: (1) the rat-proofing of buildings; (2) removal of rat food-supply; (3) trapping; and (4) poisoning. In advising against the use of methods that may be based upon the culture of bacteria, viruses, etc., the *Bulletin* says:

"The objection to these lies in the fact that they are uncertain in their action, owing to rapid loss of virulence and, more important, they may be of distinct detrimental value in causing diseases that may be harmful to man. While these products are supposed to be harmless to human beings, it is a fact that the bacteria used belong to the food-poisoning group of bacilli and may at any time develop a pathogenic power for man. Experts in this sort of work advise strongly against the use of such products."

An Acknowledgment to M. Benoit-Levy

THROUGH an oversight THE AMERICAN CITY failed to give credit to Georges Benoit-Lévy, Director, Association des Cités-Jardins de France, Boulevard Garavan, Menton, France, for his courtesy in making available the illustrations and description of Bournville, England, which appeared in the issue of February, 1925.

YOUR RESPONSIBILITY

When you approve a requisition for playground equipment, you immediately assume grave responsibilities. You are responsible for the safety of the children who will use the apparatus for years to come. You are responsible to taxpayers, because they depend upon your judgment, to buy for economy and durability. This means apparatus that costs less in the long run—and will still be in daily service after the children who use it have children of their own.

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is built with three fundamental principles in mind. It must be SAFE. It must be DURABLE, and therefore ECONOMICAL. Fred Medart began making gymnasium and playground apparatus in 1873—it stands to reason that by now it must be as nearly perfect as it can be made.

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The City's Legal Rights and Duties

Conducted by A. L. H. Street, Attorney at Law

City's Control Over Underground Operations

THE power of a city to restrict an abutting property owner in the use of space below the surface of the street depends largely upon whether the city owns the fee to street—which is seldom the case—or whether the fee is vested in the abutters—which is usually the fact.

In the case of Tacoma Safety Deposit Company vs. City of Chicago, 93 Northeastern Reporter, 868, the Illinois Supreme Court ruled that the right of the defendant city to charge rent for use of subsidewalk space depended upon the city's ownership of the fee. It was noted that to permit a vault to be constructed under a street by an abutting property owner, when he owns the fee, and yet to require him to pay rent for use of such space would be to impose an unlawful burden upon him, having the effect of taking his property rights from him without due process of law, and without paying him due compensation therefor, under the claim of regulating the use of the streets. But, drawing a distinction in the case of municipal ownership of the fee of street space, the Court added:

"The contention is made by the complainant that the city is without power to pass an ordinance requiring persons who use subways beneath sidewalks adjoining their property, to pay compensation for the use of such space. The position of the complainant, we think, is well founded as to subways beneath sidewalks in streets of which such persons are the owners in fee; but as to subways beneath sidewalks in streets in which the fee is in the city or in the state, and which are held for the use of the city, we do not think this is true."

In the same case it was held that the city's grant of a building permit involving construction of a vault under a street, the fee of which belonged to the city, would not preclude it from afterwards demanding pay for use of that space.

The Illinois Supreme Court in another case —Sears vs. City of Chicago, 93 Northeastern Reporter, 158—decided that, for similar reasons, the city's right to exact from an abutter a $10,000 bond to indemnify the city against claims arising out of use of the space under a street must depend upon the city's ownership of the fee.

In the case of Lincoln Safe Deposit Company vs. City of New York, 103 Northeastern Reporter, 768, the New York Court of Appeals declared that where a city owns the fee of a street, a permit granted to an abutter to maintain a vault under the street does not give him a perpetual right. It was held that the permit might be revoked to enable construction of a municipal subway. The Court said:

"Permits for vaults, like those to maintain areaways, stoops, courtyards, save such structures from being unlawful obstructions of the highway and nuisances, but are subject to abrogation for public convenience or necessity. It would be unreasonable to assume that the city, after acquiring the land for public use, should immediately proceed to alien parts so acquired, and that, when under change of circumstances the public require or desire either the whole of the land or the use of some part of it which hitherto the abutter has been permitted to use for his private benefit, the city should be put to another condemnation proceeding."

"Nor do I see," declared Chief Justice Cullen, who wrote the opinion of the Court of Appeals in the last cited case, "any reason why the right of the public authorities to recall the privilege granted the plaintiff and similar privileges should be limited to cases where such recall is necessary for street purposes. The very object of acquiring title in fee as distinguished from an easement is to vest in the public the right to use the land for all purposes."

When the city does not own the fee, possessing but a mere easement over the strip of land for the purposes of public travel, etc., the owner of the fee may use the subsurface in any manner and for any purpose not inconsistent with the full and free enjoyment of the easement. (Colegrove Water Company vs. Hollywood, 151 California Reports, 425.) In the cited case, the California Supreme Court declared:

"In city streets the easement of the public is, as a result of the conditions of urban life, more extensive than in roads through the sparsely inhabited regions. In cities, it is customary to

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Alundum Tiles, Treads and Aggregates

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All types of Norton Floors are made permanently slipproof, durable and quiet by the bonded electric furnace abrasive, trademarked "Alundum"—long used in the well-known Norton Grinding Wheels.

The elevator landing is now receiving much consideration from the building inspector, building owner, manager and safety engineer. A floor material used as a landing is not satisfactory unless it is both safe (slip-proof) and durable. In the illustration above the dark strip immediately in front of the elevators is one of the Norton Floors products, Alundum Aggregate Slabs. Such a landing has the qualities of safety and permanence. Even stormy weather creates no hazard for water does not lessen the slip-proof effectiveness of this floor material. It has the additional advantage of being attractive and suitable for the most luxurious type of building.

NORTON COMPANY, Worcester, Mass.

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devote not only the surface of the street, and the space above the street, to public use, but the municipality may, and frequently does, occupy the soil beneath the surface for the accommodation of sewers, gas and water pipes, electric wires, and conduits for railroads. Where the city undertakes to occupy the space above or below the surface of the street, for any purpose within the scope of the public uses to which highways may be put, the use by the owner of the fee must yield to the public use. Furthermore, the use by the owner of the fee is subject to reasonable regulation in the interest of the comfort and convenience of the community as a whole."

The Court went so far as to add:

"And, inasmuch as the right to use the soil below the surface is one that can rarely be practically enjoyed without first disturbing the surface temporarily in making the necessary excavations, it must be held that the owner of the soil has the right to make such excavations as will enable him to install the materials or do the work requisite for an enjoyment of his rights in his land."

The conclusions reached in this case are in line with the decision of the Massachusetts Supreme Judicial Court in the case of Allen vs. Boston, 34 Northeastern Reporter, 519.

Where an abutting owner has rightfully constructed an areaway under a street, the city is as much liable for negligently flooding it as for flooding abutting property, according to the holding of the South Dakota Supreme Court in the case of Dell Rapids Mercantile Company vs. City of Dell Rapids, 75 Northwestern Reporter, 898. In this case damages were awarded on account of the city's negligent failure to so maintain its sewers as to take care of rainfall. The city unsuccessfully relied upon a defense that one who occupies space below a street surface does so at his own peril. The Court said on this point:

"Manifestly, the rights and duties of one who owns the soil to the center of the street are essentially different from the rights and duties of one whose fee-simple title is limited by the lines of his lot ..... Assuming that Cooley owned the soil to the center of the street, he was at liberty to use it, subject to the public easement, the same as other parts of his property, and the construction of the area was not in itself unlawful."

But the same opinion recognizes that the abutter does not acquire vested rights to continued use of the subsurface space as against subsequent public needs. On this phase, the South Dakota Court observed:

"Undoubtedly, a city has the right to invade the limits of an area for the purpose of constructing sewers, laying gas- or water-mains, or using the entire street for any usual public improvement; but so long as such an area is not invaded by the necessities of the public, it is the duty of the city to recognize the rights of the private proprietor, and exercise ordinary care in making and maintaining its improvements."

Items of Municipal Law

City Held Not Liable for Traveler's Collision in Temporarily Closed Street

A city has the undoubted right to close temporarily one or more of its streets, for the purpose of making repairs thereon, or for the safety and convenience of the public, by placing obstructions therein: and where it has so closed, and the obstructions are temporary and reasonable in their character, the city will not be liable for personal injuries resulting from a person's driving against such obstructions, unless it further appears that the city failed to exercise ordinary care and diligence in safeguarding the obstructions (Georgia Court of Appeals, City of Blakely vs. Funderburk, 125 Southeastern Reporter, 602).

Traffic Officers Not Exempted from Exercise of Ordinary Care

A motor-cycle policeman was denied the right to recover damages on account of injuries sustained in colliding with defendant's automobile, which veered to the left into the path of the motor-cycle without warning, where the policeman was driving at negligently high speed in attempting to overtake a speeder ahead, when the Wisconsin Supreme Court handed down its decision in the case of Suren vs. Zuege, 201 Northwestern Reporter, 722.

The Court holds that an exemption of a police officer from a local law fixing speed limits to be observed by motorists, "while rendering him immune from prosecution or preventing the application of the rule that such excess of speed may establish a *prima facie* presumption of negligence, does not absolve him from the duty to exercise that which, under those circumstances and conditions, is reasonable and ordinary care for the safety of others and himself."

An Ordinance Conflicting with State Law Is Invalid

Because an ordinance of an Iowa town, forbidding operation of tractors on oiled streets of the town, was found to be at variance with provisions of a state law regulating the use of such vehicles on the public streets and highways, the Supreme Court of the state lately declared the ordinance to be void. (Town of Randolph vs. Gee, 201 Northwestern Reporter, 567). In giving an opinion, the Court said:

"It is plain that an ordinance which prohibits the use of all traction engines, no matter how equipped, and without regard to weight, upon streets not improved with gravel or pavement, not only contravenes a declared policy of the state as found in its legislation, but is in direct conflict with, and in violation of, the express provisions of the statute."

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Zoning Notes

Prepared by Frank B. Williams
Author of "The Law of City Planning and Zoning"
From data collected by the Zoning Committee of New York (233 Broadway)
Mr. Williams may be addressed in care of THE AMERICAN CITY, 443 Fourth Avenue, New York

Recent Zoning Ordinances

DENVER, COLO.—Ordinance, 1925
MISHAWAKA, IND.—Ordinance, March 27, 1925
MAMARONECK, N. Y.—Ordinance, March 2, 1925
PATCHOGUE, N. Y.—Ordinance, March 31, 1925
SARATOGA SPRINGS, N. Y.—Ordinance, December 8, 1924

Department of Commerce List of Zoned Communities

Under date of March, 1925, the Department of Commerce, at Washington, D. C., has issued a list of state zoning laws and municipal zoning ordinances, revised to January 1, 1925. Copies of this list, which has been published under the title of "Zoning Progress in the United States," may be had upon application to the Department of Commerce, Division of Building and Housing, Washington, D. C. A reproduction of the list will also be found on pages 57 to 60 of THE MUNICIPAL INDEX for 1925, published by THE AMERICAN CITY.

Recent Zoning Decisions

CALIFORNIA.—*Miller v. Board of Public Works of City of Los Angeles, Supreme Court, February 27, 1925.* The text of this decision, previously referred to in this department, is now at hand. The reader will remember that the permit sought was for a four-family house in a district reserved, by the zoning ordinance, for residences housing not more than two families. The ordinances involved were a so-called "interim" ordinance, followed by a comprehensive ordinance. In a long, carefully reasoned opinion the Court sustains the two-family house district, comprehensive zoning and the interim ordinance as a first step toward a comprehensive ordinance.

CALIFORNIA.—*Zahn and Ross v. Board of Public Works of City of Los Angeles, Supreme Court, February 27, 1925.* The opinion in this case, already given in these "Notes" in previous months, is now at hand. In sustaining the zoning ordinance generally, the Court contents itself with saying that the validity of zoning generally, as a proper use of the police power, is affirmed in the Miller case, just decided by this Court. In upholding the employment of the power in this particular case as reasonable the Court reviews the facts with care and in considerable detail. In this connection the judges show a real knowledge and appreciation of provisions technical in character, which in fact promote general comfort and convenience. Thus they see that "the reason for the inclusion of the ten blocks in Wilshire Boulevard where La Brea Avenue intersects it in Zone C was to avoid a situation which would otherwise have resulted in placing business property and residential property within the same block. In short, it was thus zoned in order that residential uses in Wilshire Boulevard would not be forced to abut upon business uses on La Brea Avenue."

In accordance with good law and good sense is the recognition of the fact that the decision as to how the area in question should be regulated was for the legislative body of the city, and not for the Court; and that the Court, having failed to find anything arbitrary or unreasonable in the action of that body, could not disturb it.

CALIFORNIA.—*Application of White Supreme Court, February 27, 1925.* The petitioner seeks his release from custody after conviction of violation of the zoning ordinance of the town of Atherton. The ordinance divides the town into two districts—the residence district and the unrestricted district. The offense of the petitioner consisted in the fact that he built a real estate office in a district reserved by the ordinance for residence. The town includes within its limits about 2,500 acres of land. The unrestricted district contains less than 1 1/10 acres, with a street frontage of only 436 feet, which is already fully occupied. Outside the town round about there is ample space suitable for business and legally available for it. *Held*, on the reasoning of the Miller case, that, in general, the establishment of residential districts from which business is excluded, is constitutional; but that the ordinance in question is unreasonable in that adequate provision for business is not made.

NEW JERSEY.—In two recent cases, the Supreme Court in holding provisions of zoning ordinances in the village of South Orange void, has done so in such a way as to allow the considerations advanced by the village, which in its opinion distinguishes these cases from the Nutley case, to be brought before the Court of Errors and Appeals. The applications were for the right to erect tenement houses in areas zoned against them, and were made by Edward Michel and by Frank B. Eaton and Lillian Eaton. In these cases it was urged that the setback provisions of the ordinance were essential to safety on account of heavy traffic in that locality, and that the erection of the tenement houses would increase the fire hazard beyond the ability of the village to cope with it.

In a third case, in which Harry Max was denied the right to locate a garage in Jersey City within 10 feet of a private residence, contrary to the zoning ordinance, the judge in distinguishing the Nutley case says that restriction with regard to garages is "quite within the police power of the city in conserving the health, safety and general welfare of the community."

NEW YORK.—Justice Callaghan of the Supreme Court, is reported in the *Brooklyn Daily Eagle* of April 9, 1925, to have directed the issuance of a permit to the Justin Building Corporation for the erection of a business building, stores and apartments on President Street. The Board of Estimate had changed the location from business to residential, and the Court sustained the contention

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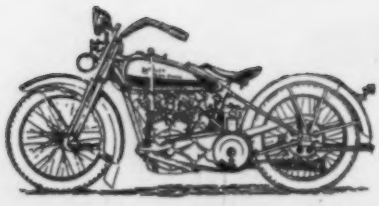

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of the architect that in that neighborhood, zoned for business, a residential district was improper.

Application of Steck for Mandamus, Supreme Court, Erie County, February 11, 1925. The Court refused the application on the ground that no reason appeared to disturb the discretionary action of the city authorities.

Application of Union Railway Co., Supreme Court, Westchester County, November, 1924. The provision of a zoning ordinance creating a one-family residence district in the village of Pelham from which tenements are excluded, is void because it is not authorized by the state law empowering villages to zone, and because such a provision is an improper exercise of the police power. It would seem also to be based upon esthetic considerations. Attention is called to the fact that there is no provision for a Board of Appeals.

Recent Zoning Literature

In the March issue of *Pacific Municipalities* there is an article on the two recent California cases, Miller v. Board of Public Works, and Zahn v. Board of Public Works, already referred to in this department. The article is entitled "Supreme Court Decides Los Angeles Zoning Cases, a Non-Technical Résumé of the Decisions," and is by H. A. Postlethwaite.

The Annual Report for 1924 of the Planning Board of Brookline, Mass., is a thin pamphlet of interest and value. It reviews the activities of the Board for the last year, not only in other fields of planning, but in zoning as well. It also gives an account of the housing situation in the town.

Adolph Grant, Esq., has issued a "Catechism of Zoning" which clarifies and explains the New Rochelle, N. Y., Zoning Ordinance. It is published by the Chamber of Commerce of New Rochelle.

The City Planning Board of Boston has issued a report entitled "Zoning for Boston—A Survey and a Comprehensive Plan." Its purpose is to explain how Boston has been zoned, and to give an idea of the civic problems that zoning will help to solve. The Boston Zoning Law, which became effective June 5, 1924, is quoted in full. In addition to photographs of actual conditions showing the need for zoning regulations, the report contains reproductions of maps and charts typical of the technical work involved.

The New York Times of Sunday, March 22, 1925, gives the resolutions adopted at the State Conference on Zoning held in Trenton under the auspices of the New Jersey State Chamber of Commerce and the Trenton Chamber of Commerce. These resolutions reaffirm the faith of its members in zoning under the police power, rather than under eminent domain, declare that in their opinion the present statute, superseding the laws under which the Nutley case was decided, is valid and will be upheld by the courts, and leave the advisability of a constitutional amendment to the decision of the Board of Trustees of the New Jersey State Chamber of Commerce.

EDITORIAL NOTE.—For an article on "Progress of City Planning Law During 1924," by Mr. Williams, the reader is referred to page 50, THE MUNICIPAL INDEX for 1925.

The Municipal Bond Market

By Sanders Shanks, Jr.

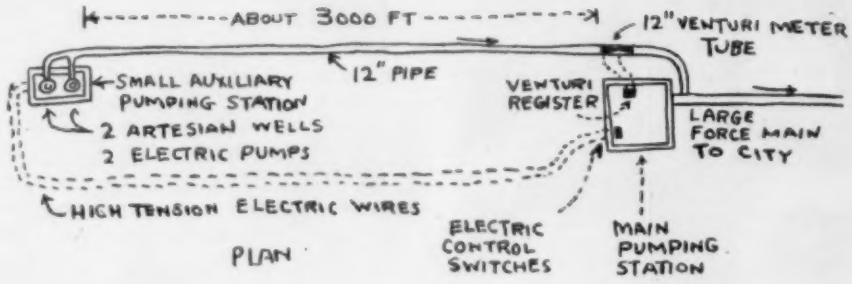
Editor, *The Bond Buyer*

NEW offerings of state and municipal bonds during the past month amounted to about $80,000,000, as compared with $100,612,002 during March (this figure was swelled by a $20,000,000 Pennsylvania highway issue) and $78,659,370 in February, when new issues suddenly started to fall off. As a result of the small number of new high-grade issues since the first of the year, those which have been floated have, in many instances, been purchased at higher prices than have been paid for bonds of those same communities in many years. The state of Michigan, for example, sold $3,000,000 at a net interest cost of 4.05 per cent, the nearest rate to this having been 4.07 per cent in 1922. Chicago Park District disposed of $2,500,000 bonds at 4.09 per cent, which is at a lower cost than the city has paid since 1911, when the net cost was 4.07 per cent. Hudson County, N. J., sold $2,419,000 1-30-year serial 4½'s on a 4.19 per cent basis during April, which was the best price paid for bonds of this county since 1916, when 4.13 per cent basis was paid for some 50-year straight-term bonds. Another case is that of Grand Rapids, which paid 4.14 per cent last month. This is the lowest interest rate that the city has secured since 1916. The foregoing instances are only an indication of similar comparisons over the entire list.

The subjoined list of new flotations during the month of April represents the largest offerings of the month and is presented as a guide to the present value of municipal bonds throughout the country:

Amount	Municipality	Maturity	Int. Rate (%)	Net Int. Cost (%)
$350,000	Sewickley, Pa., Sch. Dist.	1926-55	4.10	3.95
585,000	Niagara Falls, N. Y.	1956-60	4	3.97
3,000,000	Michigan	1940	4¼	4.05
600,000	Hazleton, Pa.	1935-54	4½	4.05
900,000	Wilkes-Barre, Pa.	1936-55	4¼	4.08
2,500,000	Chicago, Ill., Park Dist.	1925-44	4	4.09
1,070,000	Grand Rapids, Mich.	1926-45	4¼	4.14
300,000	Gary, Ind., Sch. Dist.	1945	4¼	4.17
500,000	Scott Co., Ia.	1926-28	4 & 4¼	4.18
751,000	Passaic Co., N. J.	1926-46	4¼	4.18
2,419,000	Hudson Co., N. J.	1927-55	4½	4.19
500,000	Dayton, Ohio	1926-50	4½	4.19
1,500,000	Omaha, Nebr., Sch. Dist.	1955	4¼	4.20
470,000	No. Tarrytown, N. Y.	1925-64	4½	4.20
484,750	Hempstead, N. Y., U. F. S. D. No. 10	1926-48	4½	4.20
360,000	Kenosha Co., Wis.	1926-45	4½	4.24
475,000	Marquette, Mich.	1930-55	4½	4.33
670,000	Cleveland Heights, O.	1926-50	4½	4.36
1,900,000	Little Rock, Ark.	1926-50	4½	4.49
500,000	Los Angeles Co., Calif., Long Beach City High Sch. Dist.	1925-54	5	4.64
870,000	Dade Co., Fla.	1930-74	5	4.65
320,000	Silver Bow Co., Mont.	1926-45	4¼	4.67
1,000,000	Dyer Co., Tenn.	1955	4¼	4.75
4,560,000	Los Angeles, Calif.	1926-65	5½	5.14
600,000	Clearwater, Fla.	1926-35	6	5.97
600,000	Bend, Ore.	1928-47	5½	5.98

A New England Town's Pumping Problem



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Municipal and Civic Publications

Prices do not include postage unless so stated

City Planning.—Official organ of the American City Planning Institute and the National Conference on City Planning. Vol. I, No. 1, April, 1925. 70 pp. Illustrated. Editor, Henry V. Hubbard; Assistant Editor, Charles W. Eliot, 2nd; Contributing Editors, Edward M. Bassett, Frank B. Williams, George B. Ford, Flavel Shurtleff, and Theodora Kimball Hubbard. This number contains the following articles and departments: Perseverance in City Planning, by Charles H. Wacker; Ideals of the New York Regional Plan, by Thomas Adams; Survey of City and Regional Planning in the United States, 1924, by Theodora Kimball Hubbard; A Greeting from the President of the International Federation, by Ebenezer Hubbard; The Responsibilities of Realtors in City Planning, by J. C. Nichols; Architectural Imagination in City Building, by Harvey Wiley Corbett; Interest of the Engineer in City Planning, by M. N. Baker; The Chamber of Commerce and City Planning, by John Ihlder; Two Years of Regional Planning in Los Angeles County, by Hugh R. Pomeroy; Legal Notes—City Planning Law in 1923 and 1924; Current Progress; Zoning Round Table; Institute News; Book Reviews and Book Lists. 75 cents a copy; $3.00 a year. Foreign, $1.00 a copy; $3.50 a year. A quarterly publication. (Apply to the City Planning Publishing Co., 9 Park Street, Boston, Mass.)

Topographic Mapping.—By L. B. Roberts. Major, Engineer Officers' Reserve Corps. Published by The Society of American Military Engineers, The Mills Building, Washington, D. C. November, 1924. 150 pp. Illustrated. $1.50.

This handy-size book is designed to simplify the difficulties that are most evident to every student of topographic map making. The author believes the modernized plane-table outfit the best topographical equipment yet devised, combining the office work of mapping with that of the field. The instruments used by the plane-table operator are described, and the methods of operating them. The various ways of indicating relief on maps are discussed. One chapter deals with the general subject of mapping and includes a set of diagrams covering every problem of the plane-table operator in obtaining distance and difference of elevation. The chapter on topographic ground forms is particularly interesting, and the final one, on the relation of aerial photography to topographic mapping, shows the important economic value of this new process.

Farm Life Abroad: Field Letters from Germany, Denmark and France.—By E. C. Branson, Litt. D., Kenan Professor of Rural Social Economics, University of North Carolina. The University of North Carolina Press, Chapel Hill, N. C. 1924. VIII + 303 pp. $2.00.

These letters give in simple narrative form many interesting facts relative to rural civilization in three foreign countries, with the idea of bringing to the people of North Carolina whatever will be of most service in their own rural development. It deals with farm systems and practices, with country communities and institutions, and standards of living, and is a worth-while presentation of the observations of a lifelong student of rural social economics.

International Town Planning Conference, Amsterdam, July, 1924.—Part II of the Report of the Conference held by the International Federation for Town and Country Planning and Garden Cities. 103 pp. Illustrated. A paper omitted from Volume I is given—"Transportation in the Regional Plan," by Raphael Verwilghen, in French, with summaries in French, German, English, and Dutch. An exceedingly interesting record of an important conference, of value to all who wish to keep in touch with the progress of town planning. (Apply to the Federation, 3 Gray's Inn Place, London, W. C. 1, England.)

Demolitions of Dwellings in Philadelphia.—A study made by the Philadelphia Housing Association. 8 pp. 1 view; 1 table. Showing the great housing loss through demolitions; the increase of congestion, since demolished houses of a certain rental range are not being replaced by new construction; certain benefits involved, in the destruction of insanitary living quarters; and the losses occurring through Philadelphia's failure to assess abutting properties for benefits derived from public improvements. The outstanding problems revealed by the study are stated, and practical recommendations are made dealing with the whole situation. (Apply to the Association, 311 South Juniper Street, Philadelphia, Pa.)

The Public and Its Utilities.—By William G. Raymond, C. E., LL. D., Eng. D., Professor of Engineering and Dean of the College of Applied Science in the State University of Iowa. John Wiley & Sons, Inc., New York. 1925. XII + 346 pp. Illustrated. $3.50.

This is a non-technical text-book for any one—engineering student, municipal or state official, attorney, accountant—who has to do with franchise making and the operation and regulation of public utilities, whether publicly or privately owned. It seeks to present a basis for the adjustment of all questions concerning the public interest in this field. The discussion covers the principles which should govern the establishment of rates; the bases for, and the nature of, proper control and regulation; what constitutes a fair rate of return to the owner of a public utility; and the determination of a fair value of the utility property.

Proceedings of the Second International Congress of Cities.—179 quarto pp. Illustrated. Apply to Union Internationale des Villes, 3bis, Rue de la Regence, Brussels, Belgium.

The Congress was held in Amsterdam June 30 and July 1, 1924. This report is given in French, and includes the preliminary documents, the reports and discussions, and the resolutions adopted. The supplements give interesting material on the Tablettes Documentaires Municipales, with specimen pages in French, German and English.

Bus Operating Practice.—Published by Mack Trucks, Inc., The International Motor Company, 25 Broadway, New York. 1925. VI + 268 pp. Illustrated. $3.00.

This is a study of bus operation that has been accepted as successful after a sufficiently long period. The basis for such a study is shown in the growth of the bus industry. How to select profitable bus fields and how to secure the right to run are explained. There is a chapter on how to establish and maintain passenger terminals and waiting rooms efficiently, economically and profitably. Other chapters cover the relations with the public, the selection of equipment, its operation, costs, and indirect and supplementary revenue.

Public Ownership.—By Carl D. Thompson, M. A., Secretary of the Public Ownership League of America. Thomas Y. Crowell Company, New York. 1925. XVIII + 445 pp. Illustrated. $3.00.

The author states his purpose to be a survey of public ownership as to the facts of such ownership and the results of its operation, rather than a presentation of theories or arguments. There is, however, in the final chapter a consideration of objections to public ownership with replies to them, and throughout the book the comparison between the results of private and of public ownership are repeatedly emphasized as favorable to the latter. Familiar forms of public ownership—the government, postal service, roads and bridges, schools, and libraries—are dealt with in the opening chapter, and this is followed by chapters on the Federal Government in business, the public ownership of railroads, and the postalization of the telegraph, telephone, cables, and radio, the nationalization of mines, public banks, banking and insurance, and state enterprises. Municipal waterworks, street railways, gas plants, electric light and power-plants, and other municipal enterprises are considered, and there is much material on the Ontario Hydro-Electric and the question of public super-power.

Financial Responsibility for Automobile Accidents.—Report of the Committee of Nine representing the stock casualty insurance companies and agents that insure the automobile liability hazard. The Chairman of the Committee is Edson S. Lott, President of the United States Casualty Company. The report is the result of a study of the problem presented by proposed and pending legislation for compulsory automobile insurance or security, a method which is stated to be only an ineffective palliative, the true remedy being accident prevention. 35 pp. (Apply to the Secretary of the Committee, 80 Maiden Lane, New York, N. Y.)

Know Dallas.—94 pp. Apply to Dallas Junior Chamber of Commerce, Dallas, Texas.

Interesting information about Dallas and its institutions, compiled by the Dallas Junior Chamber of Commerce, under authority of Norman R. Crozier, Superintendent of Schools, and printed in the Dallas High Schools Printshop, for use in the public schools of the city. It gives a historical sketch of Dallas, describes and explains the city government and its services, and shows the city's advantages and facilities.

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Women Police.—By Chloe Owings, of the American Social Hygiene Association. A 6-page reprint from the Journal of Social Hygiene, January, 1925. Presenting a statement of the development of the movement, the program of work, and the endorsement of the movement, with a selected bibliography. (Apply to the American Social Hygiene Association, 370 Seventh Avenue, New York, N. Y.)

Public School Salaries in 1924-1925.—Research Bulletin of the National Education Association for January and March, 1925. Published by the Research Division of the Association, 1201 Sixteenth Street N. W., Washington, D. C. 72 pp. Charts, tables. The most comprehensive inquiry on public school salaries yet made. It gives salary facts for 521,395 administrators, teachers, and other school employees. Here, for the first time, comprehensive salary information is made available in the same school year in which the data were gathered. (Apply to the publishers.)

Summer Camps.—Two reprints from "Camping Out," published last year by the Playground and Recreation Association of America, reprinted by permission of The Macmillan Company, New York. "Camp Sanitation," by George C. Dunham, M. D., Dr. P. H., D. T. M. & H., Fellow, A. P. H. A., Major, Medical Corps, U. S. Army; 100 pp., illustrated; 25 cents; a full and practical treatment of the various phases of camp sanitation —securing a pure water-supply, disposal of wastes, provision for bathing, insect control, control of infectious diseases, etc. "Accounting for Camps," by Irving Ornstein, C. P. A., and Louis A. Rifkin, B. C. S., C. P. A., 57 pp., with accounting forms; 15 cents; treated under four main headings—Classification of Accounts, Books of Account, Financial Statements, Forms. (Apply to Playground and Recreation Association of America, 315 Fourth Avenue, New York, N. Y.

Objectives in Sewage Treatment.—By Jack J. Hinman, Jr. A paper presented at the Sixth Conference on Sewage Treatment, at Ames, Iowa, October 28-30, 1924. Bulletin 69 of the Engineering Extension Department, Iowa State College, Ames, Iowa. December 24, 1924. 12 pp. The pamphlet deals with the necessity of making the sewage effluent of such a quality that there will be no damage suits, injunctions, or other impediments to the use of the stream into which the sewage is discharged. The objections to water pollution are stated and then considered more fully, as to means of overcoming them. (Apply to author, P. O. Box 313, Iowa City, Iowa.)

Swimming Pools.—An illustrated booklet of 20 quarto pp. Published by the Portland Cement Association, 111 West Washington Street, Chicago, Ill. Condensed specifications for concrete swimming pool construction are given, and well-illustrated material on design and construction of concrete pools, with their equipment. Detailed construction plans. There is a section on wading pools, with the plan of a suggested design. Material on sanitation and financing is also included. (Apply to the Association.)

Civic Control of Metropolitan Areas.—A report of Irenaeus Shuler to the Home Builders and Subdividers Division of the National Association of Real Estate Boards at Dallas, Texas, January 14, 1925. 8 pp. Showing the importance of proper planning of metropolitan areas outside of corporate limits, the extent to which this is being done, what methods are used, and the responsibility of realtors for adoption of master plans. (Apply to National Association of Real Estate Boards, 310 South Michigan Avenue, Chicago, Ill.)

Learning to Live in America.—A Report for 1924 of the Playground and Recreation Association of America, 315 Fourth Avenue, New York City. 27 pp. Illustrated. The "Bird's-Eye View of National Service in 1924," covering cities and individuals reached with help toward better recreational opportunities, is impressive, and the intensely human account of the way in which the Association is enriching American life should be read by every one. (Apply to the Association.)

The Handling of Conventions.—Prepared by John N. Van der Vries. One of a series of pamphlets issued by the Organization Service Bureau of the Chamber of Commerce of the United States, Washington, D. C. 12 pp. An outline of the important details to be considered in the preparation for, and the carrying through, of an annual meeting or convention of a trade, professional, or other type of organization. Chambers of commerce interested in rendering service to organizations which hold conventions in their communities may obtain copies to place in the hands of the secretaries of these organizations as a help in planning for forthcoming meetings. (Apply to Colvin B. Brown, Chief of the Bureau.)

Palos Verdes Bulletin.—The Palos Verdes Homes Association, Redondo Beach, Calif., is publishing an interesting illustrated monthly bulletin, which records the progress and development of the community, and the steps taken by the Association, the Art Jury and the administrative officers, with helpful information about better architecture, planting, etc. (Apply to the publication office, Room 258, Hotel Redondo, Redondo Beach, Calif.)

Stream Pollution in Illinois.—Two papers in one pamphlet. Comparison of Chemical and Bacteriological Examinations Made on the Illinois River During a Season of Low and a Season of High Water, 1923-1924, by R. E. Greenfield. A Preliminary Notice of a Survey of the Source of Pollution of the Streams of Illinois, by G. A. Weinold, R. E. Greenfield, and A. M. Buswell. Bulletin No. 20 of the Division of the State Water Survey of the State Department of Registration and Education. 50 pp. Views, maps, charts, tables. It is believed that the collection of such data as given here should aid materially in planning the steps to be taken toward conserving the usefulness of the streams of the state. (Apply to the State Water Survey, Urbana, Ill.)

Giant Power.—Large Scale Electrical Development as a Social Factor. The March, 1925, issue of The Annals of the American Academy of Political and Social Science, 39th Street and Woodland Avenue, Philadelphia, Pa. 177 pp. The editor in charge of this volume is Morris Llewellyn Cooke, Director of Giant Power Survey of Pennsylvania. The Introduction is by Governor Pinchot, and the 31 articles by authorities in the various divisions of this field of investigation are grouped under six heads: National Power Programs; Rural Electrification; Labor and Industry; Miscellaneous; Technical; Legal. (Apply to The Annals.)

American Road Builders' Association.—Proceedings of the Twenty-second Annual Convention of the Association, held in Chicago, Ill., January 6-8, 1925. Including a list of exhibitors at the Sixteenth National Good Roads Show. 210 pp. Illustrated. Papers and discussion on general and technical phases of the highway industry, by men of experience and eminence in highway development. $3.00. (Apply to Wm. Jabine, Director of Publicity, American Road Builders' Association, 37 West 39th Street, New York, N. Y.)

Water Supplies for Rural Schools.—By Jack J. Hinman, Jr., Chief, Water Laboratory Division, Iowa State Board of Health, and Associate Professor of Sanitation, State University of Iowa. In the January-February-March, 1925, issue of the Iowa Health Bulletin, published at Des Moines, Iowa, by order of the State Board of Health. 16 pp. Illustrated. Giving definite information on types of well supplies and how to secure, distribute and use pure water in a sanitary way. (Apply to the Bulletin.)

Lynchburg in Old Virginia.—Compiled and published by the Publicity and Advertising Committee of the Chamber of Commerce. An elaborate, attractive and interesting booklet of 48 quarto pp., with many illustrations, setting forth the opportunity and future of Lynchburg. The running heads at the bottom of the pages give items of interest regarding many features of the city's advantages and facilities. (Apply to the Chamber of Commerce, Lynchburg, Va.)

Rapid Transit for St. Louis.—By C. E. Smith, consulting engineer, St. Louis. A paper presented to the Associated Engineering Societies of St. Louis, under the auspices of the Engineers' Club, November 5, 1924. 20 pp. This report includes statements of rapid transit progress in various cities visited in 1924 by a St. Louis Special Aldermanic Committee on Rapid Transit: Philadelphia, New York, Boston, Detroit, Chicago, London, Paris, and Berlin. On its return from this trip, the Committee rendered a very enthusiastic report in favor of rapid transit. (Apply to the author.)

School Attendance in the United States, 1920.—By Frank Alexander Ross. Census Monographs V. XX+285 pp. Charts, tables. "No other body of data exists that can be used to compare region with region, state with state, county with county, city with city, ethnic class with ethnic class, decade with decade." Published 1924. $1.25. (Apply to Government Printing Office, Washington, D. C.)

The City of St. Louis—An Outline of Its Civic Activities.—By Lucius H. Cannon, Librarian, St. Louis Municipal Reference Library. 3 pp. in "Know St. Louis Weekly" for March 8, 1925. An interesting summary, with statistical details, of the city's activities under the bond issue, and of the facilities and advantages afforded by the various civic institutions. (Apply to Know St. Louis Publishing Co., 212 Olive St., St. Louis, Mo.)

Forest Fires and Taxation.—By K. E. Kimball, District Forester, Southeastern District, North Carolina. Circular No. 11 of the State Forest Service, Raleigh, N. C. 1925. 15 pp. A brief study of present forest conditions in ten counties of North Carolina relative to the destruction of forest values by fire and the effect of consequent reductions in property values on county tax rates. (Apply to J. S. Holmes, State Forester, Raleigh, N. C.)

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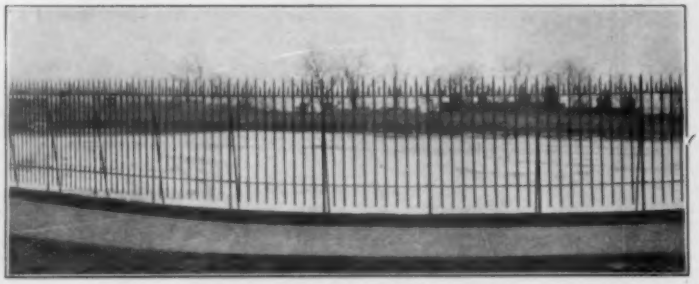

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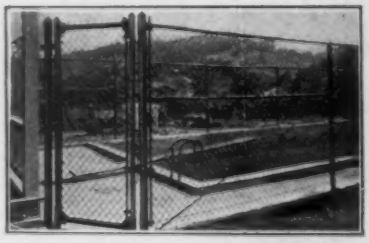

The Small Sewage-Treatment Plant.—By Earle L. Waterman, Associate Professor of Sanitary Engineering, State University of Iowa. Bulletin 68 of the Engineering Extension Department, Iowa State College, Ames, Iowa. December 31, 1924. A paper presented at the Sixth Conference on Sewage Treatment, at Ames, Iowa, October 28-30, 1924. 10 pp. 1 drawing. Dealing briefly with the fundamentals which the small-plant operator should consider. (Apply to the Engineering Extension Department, Iowa State College, Ames, Iowa.)

Sanitation Surveys.—By W. H. Larkin, Assistant Engineer, Iowa State Department of Health. Bulletin 70 of the Engineering Extension Department, Iowa State College, Ames, Iowa. A paper presented at the Sixth Conference on Sewage Treatment, at Ames, Iowa, October 28-30, 1924. 11 pp. A brief statement of the essentials of adequate survey procedure, with descriptions of conditions often found in such surveys. (Apply to the Department.)

International Association of Street Sanitation Officials.—Proceedings of Fifth Annual Conference, Chicago, January 5, 6, 1925. 39 quarto pp. Verbatim discussion of many phases of the street-cleaning problem. (Apply to the Secretary of the Association, A. M. Anderson, 10 South LaSalle Street, Chicago, Ill.)

Reports Received

COOK COUNTY, ILL.—Comptroller's Report, for fiscal year ended December 2, 1923, and brought down to January 7, 1924

LAPRAIRIE, QUE.—Financial Report, December 31, 1924

LOS ANGELES, CALIF.—Annual Message of Mayor George E. Cryer, January 2, 1925

MULTNOMAH COUNTY, ORE.—Budget Facts and Financial Statistics for 1925

PROVINCE OF QUEBEC.—Municipal Statistics, 1923

SOUTH BEND, IND.—Annual Report, 1924

From the International Union of Cities

Items translated from "Tablettes Documentaires Municpales" by Stephen Child, 410 Maryland Building, Washington, D. C., to whom requests for further information regarding this source of civic documentation should be addressed

City Planning Education in Germany. 71 (43) (07)

A department of City Planning and Housing has recently been organized in the Polytechnical School of Charlottenburg. Its purpose is, through theoretical and practical courses of instruction, to give, to both technical and administrative municipal officials, information enabling them to meet the modern demands of city planning. Something of this sort was begun in 1908, but was interrupted by the war and is now being more fully developed. Effort is to be made to bring about a thorough cooperation with similar institutions in other countries.

City Planning Topographical Maps, Paris. 71:52.69

A new, inexpensive method has been developed in France for preparing sectional and contour maps by employing stereoscopic photography. Two stereoscopic views, each 6 x 16 centimeters in size, are taken from a base line whose length is in proportion to the scale of the plan to be prepared. These photographs are then examined with a strong stereoscopic glass. Employing an indicator or index (attached to a pantograph) which can be moved in three directions, and moving this over the different points of ground examined under the stereoscopic lenses and by means of guides, so as to traverse the contour line, these and other details are transferred to paper at the correct scale. Elevations or altitudes are read from a cylinder in front of which a level is placed, which gives the heights with reference to the datum employed. (Translator's note: For further details of this apparently very interesting and useful method of securing topographical maps cheap, but of sufficient accuracy for preliminary study, the reader is referred to "La Technique Moderne," Paris, October 1, 1924. No. 19, p. 19.)

City Planning and Industrial Architecture in Austria. 71.31; 72.54 (43.6)

The city of Vienna in its new development is taking on the character of a great commercial and industrial city. Alongside the "City of the Palaces" there is being prepared a second city, in which commercial buildings and factories will predominate. These two sorts of buildings will give their character to the future Vienna. It becomes a question, therefore, of solving the problem of adapting, from the esthetic point of view, these commercial buildings and factories to the urban situation. By the adoption of various practical and adequate building regulations, by the happy disposition of areas reserved for factories and the rhythmic division of the façades of these factories by means of the grouping of windows, with stairway enclosures and elevators arranged in bays or towers, it is easy to realize architectural effects that will have a permanent urban value.

State Aid for Housing Ownership in Belgium. 33.332: 35.078.5 (493)

By royal decree the Belgian Government in 1922 decided to grant a premium of from 2,000 to 3,500 francs for the building of houses by individuals. This did not produce important results, and therefore the law has been modified as follows: To purchasers of houses built through the assistance of organizations affiliated with the National Bank of Savings, or with the National Society for Inexpensive Housing, there is accorded first, a premium of from 2,000 to 3,900 francs, according to the importance of the town and the size of the family; second, a supplementary premium of 8 per cent of the price of the house, compensating for the cost of regulations as to registration and transcription of agreements. Up to the 10th of April, 1924, 10,355 individuals desirous of obtaining these premiums had been recorded; 1,455 of these requests have been liquidated; 3,168 briefs of requests have been submitted to examination; 5,172 requests for instructions have been received. As to the sales by the above-mentioned National Society: up to the end of 1923, 1,847 proposals had been introduced, of which 128 have been settled. These sales furnished capital to be employed in new houses. Neither the Nation nor the Bank may continue to advance new capital. In fact, from 1889 to July, 1914, the outbreak of the war, the National Bank above mentioned, had advanced 90,000,000 francs. The advances or loans since the Armistice hve been almost as much—88,000,000 francs. The National Government has prepared an appeal to manufacturers urging them to cooperate with the public authorities in furthering this movement for home ownership.

Building Material for Houses in Great Britain. 69.35 (42)

The manufacture of brick being insufficient in England, it is becoming necessary to employ other materials. Among these, reinforced concrete is found to have important advantages, and remedies have been perfected for most of the former defects of this material. In quite a number of large cities houses have been built in this manner, and the officials continue to employ this material because they are satisfied with results. Among these cities, Edinboro has just begun the construction of 1,000 houses, to comprise 2,750 apartments. At Birkenhead, near Liverpool, also many cement houses have been built.

Housing in Holland. 72.8

The building of houses in Holland is to be aided by the publication of a series of pamphlets. These will inform architects who wish to cooperate in the mass construction of houses, giving them the benefit of the most economical methods in order that they may be able to build at the lowest possible cost, apartments or lodgings arranged in the most practical manner. Private builders also will be able to learn, through these publications, of details of the work of many architects; how an architectural objective—one that breaks away from the routine of prescribed showy and false formulas—may permit a reduction in building costs and also realize ensembles that are in good taste.

Housing in Bavaria, Germany. 33.332 (433)

In Munich, new measures have just been added to those adopted in 1918, with a view to encouraging the building of houses and apartments. These amendments include a reduction in taxes on buildings; the authorization of paying by default for the cost of street pavements; the free installation of both gas and electric connections; furthermore, it is proposed to extend this provision to water-supply also. It is hoped by these methods to encourage the building of small homes and apartments.

A Strong and Attractive Fence

that will be a permanent investment. **Excelsior Rust-proof Chain Link Fence**, the first chain link fence to be hot galvanized after weaving, is made of selected bright steel wires of high tensile strength. Will not sag or rust out.

The illustration below shows Excelsior Hot Galvanized After Weaving Chain Link Fence used effectively to enclose public buildings, making them safe against intrusion, without detracting from their beauty.

Furnished with complete instructions and fittings, or erected by our experienced fence erectors. Write for catalog showing our Chain Link and Ornamental types of fencing. Our fence engineers will be glad to work with you.

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On the Calendar of Conventions

MAY 12-14.—CHICAGO, ILL.
National Fire Protection Association. Annual convention. Secretary, Franklin H. Wentworth, 40 Central Street, Boston, Mass.

MAY 12-16.—NEW YORK, N. Y.
International Police Conference. Annual convention. Secretary, Colonel R. Waldo, 240 Centre Street, New York, N. Y.

MAY 13-15.—CLEVELAND, OHIO
American Federation of Arts. Annual meeting. Secretary, Miss Leila Mechlin, 1741 New York Avenue, Washington, D. C.

MAY 13-15.—COLORADO SPRINGS, COLO.
Colorado Municipal League. Annual convention. Secretary, Don C. Sowers, University of Colorado, Boulder, Colo.

MAY 17-21.—ST. LOUIS, MO.
American Association of Museums. Annual meeting. Director, Charles R. Richards, 2 West 46th Street, New York, N. Y.

MAY 19-21.—CHICAGO, ILL.
National Firemen's Association of the United States. Annual convention. Secretary, Captain J. E. Mersch, 715 Monroe Street, Evanston, Ill.

MAY 19-21.—CHATTANOOGA, TENN.
Southeastern Water and Light Association. Annual convention. Secretary, W. F. Stieglitz, Columbia, S. C.

MAY 20-22.—WASHINGTON, D. C.
Chamber of Commerce of the United States of America. Annual meeting. Secretary, D. A. Skinner, 1615 H Street, N. W., Washington, D. C.

MAY 25-28.—WASHINGTON, D. C.
Annual Conference on Weights and Measures. Secretary, F. S. Holbrook, Bureau of Standards, Washington.

MAY 25-28.—MILWAUKEE, WIS.
National Association of Purchasing Agents. Annual convention. Secretary, W. L. Chandler, Woolworth Building, New York, N. Y.

MAY 25-30.—LOS ANGELES, CALIF.
Assembly of Civil Service Commissions. Annual meeting. Secretary, Chas. S. Shaughnessy, Chief Examiner, Philadelphia City Commission, Philadelphia, Pa.

MAY 28-30.—WASHINGTON, D. C.
National Conference on Outdoor Recreation. Annual meeting. Executive Secretary, Arthur C. Ringland, Room 2034, New Navy Building, Washington, D. C.

MAY 28-30.—MARLIN, TEX.
Texas Commercial Executives' Association. Annual meeting. Secretary, John Boswell, Plainview, Texas.

JUNE 1-2.—SARASOTA, FLA.
Florida State Commercial Secretaries' Association. Annual meeting. Secretary, Geo. H. Clements, Bartow Chamber of Commerce, Bartow, Fla.

JUNE 2-4.—SYRACUSE, N. Y.
Conference of Mayors and Other City Officials of the State of New York. Annual meeting. Secretary, William P. Capes, 25 Washington Avenue, Albany, N. Y.

JUNE 2-5.—ORLANDO, FLA.
American Association of Engineers. Annual meeting. Acting Secretary, Miss M. E. McIver, 63 East Adams Street, Chicago, Ill.

JUNE 5-6.—WAYNESBORO, PA.
Pennsylvania Commercial Secretaries' Association, Semi-annual meeting. Secretary-Treasurer, Donald J. Howard, Chamber of Commerce, Altoona, Pa.

JUNE 7-9.—SHEBOYGAN, WIS.
Wisconsin Association of Commercial Secretaries. Annual meeting. Secretary-Treasurer, Lee I. Yorkson, Wausau, Wis.

JUNE 10-12.—ALEXANDRIA, MINN.
League of Minnesota Municipalities. Annual convention. Executive Secretary, Morris B. Lambie, The Municipal Reference Bureau, University of Minnesota, Minneapolis, Minn.

JUNE 10-17.—DENVER, COLO.
American Association for Community Organization. Annual meeting. Secretary, Pierce Williams, care National Information Bureau, 215 Fourth Avenue, New York, N. Y.

JUNE 10-17.—DENVER, COLO.
National Conference of Social Work. Annual meeting. Secretary, William H. Parker, 25 East 9th Street, Cincinnati, Ohio.

JUNE 12-15.—DENVER, COLO.
American Association of Social Workers. Annual meeting. Executive Secretary, Philip Klein, 130 East 22nd Street, New York, N. Y.

JUNE 15-17.—BILOXI, MISS.
Southern Commercial Secretaries' Association. Annual Convention-School. Secretary, Burke Hopgood, Chamber of Commerce, Durham, N. C.

JUNE 15-19.—SAN FRANCISCO, CALIF.
National Electric Light Association. Annual meeting. Managing Director, M. H. Aylesworth, 29 West 39th Street, New York, N. Y.

JUNE 15-20.—MINNEAPOLIS, MINN.
National Tuberculosis Association. Annual meeting. Managing Director, Dr. Linsly R. Williams, 370 Seventh Avenue, New York, N. Y.

JUNE 22-26.—SARATOGA SPRINGS, N. Y.
American Institute of Electrical Engineers. Annual convention. Secretary, F. L. Hutchinson, 33 West 39th Street, New York, N. Y.

JUNE 22-26.—ATLANTIC CITY, N. J.
American Society for Testing Materials. Annual meeting. Secretary, C. L. Warwick, 1315 Spruce Street, Philadelphia, Pa.

JUNE 22-27.—LOS ANGELES, CALIF.
American Physical Education Association. Annual convention. Secretary, Dr. J. H. McCurdy, Box G, Highland Station, Springfield, Mass.

JUNE 22-27.—SWAMPSCOTT, MASS.
Special Libraries Association. Annual convention. Secretary, Estelle Liebman, E. I. Du Pont De Nemours & Company, Wilmington, Del.

JUNE 22-28.—On board S. S. Richelieu, en route from Montreal, Que., to Charlottetown, P. E. I.
Union of Municipalities of the Province of Quebec. Annual convention. Secretary, R. Prieur, 326 Transportation Building, Montreal, Que.

JUNE 23-26.—DETROIT, MICH.
National Association of Real Estate Boards. Annual convention. Executive Secretary, Herbert Nelson, 310 South Michigan Avenue, Chicago, Ill.

JUNE 24-26.—ROCHESTER, N. Y.
American Association of Nurserymen. Annual convention. Executive Secretary, Charles Sizemore, Louisiana, Mo.

JUNE 25-27.—TULSA, OKLA.
United States Junior Chamber of Commerce. Annual convention. Secretary, A. C. Kellar, 608 Scripps Building, San Diego, Calif.

JUNE 28-JULY 3.—INDIANAPOLIS, IND.
National Education Association of the United States. Annual meeting. Secretary, J. W. Crabtree, 1201 Sixteenth Street, N. W., Washington, D. C.

JULY 5-11.—STANFORD UNIVERSITY, PALTO ALTO, CALIF.
Western School for Commercial Executives. Address: Prof. Edwin A. Cottrell, Stanford University, Palo Alto, Calif.

JULY 6-11.—SEATTLE, WASH.
American Library Association. Annual conference. Executive Secretary, Carl H. Milam, 86 East Randolph Street, Chicago, Ill.

JULY 20-AUGUST 1.—EVANSTON, ILL.
National School for Commercial and Trade Executives. Address: Robert B. Beach, Business Manager, Chicago Association of Commerce, 10 South La Salle Street, Chicago, Ill.

JULY 21-23.—ROCHESTER, N. Y.
National Association of Comptrollers and Accounting Officers. Annual meeting. Secretary, Mark M. Foote, Comptroller's Office, 501 City Hall, Chicago, Ill.

AUG. 17-20.—DETROIT, MICH.
International Association of Municipal Electricians. Annual meeting. Secretary, Wm. R. Arbuckle, 99 West 41st Street, Bayonne, N. J.

SEPT. 8-11.—On board S. S. Richelieu, en route from Montreal to Quebec.
New England Water Works Association. Annual convention. Secretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

SEPT. 29-OCT. 2.—LOUISVILLE, KY.
International Association of Fire Engineers. Annual convention. Secretary, James J. Mulcahey, City Hall, Yonkers, N. Y.

OCT. 26-28.—KANSAS CITY, MO.
National Association of Commercial Organization Secretaries. Annual meeting. Secretary-Treasurer, A. V. Snell, Chamber of Commerce, Jacksonville, Fla.

OCT. 26-29.—DES MOINES, IOWA
American Society for Municipal Improvements. Annual convention. Secretary, Charles Carroll Brown, P. O. Box 1134, Lakeland, Fla.

Greater Mowing Economy With the New Ideal

IN THIS—the *new* model Ideal—is offered new mechanical features that mean added years of service, easier operation, less up-keep and greater satisfaction. In short, the reliable Ideal upon which leadership was built has been made a ***still better Ideal.***

It is a labor and money saver—certainly; but more important still it is a practical, long lived, trouble-free machine. It does the work of five or more men with hand mowers and rolls as it cuts. It builds a fine, well kept, smooth lawn at a nominal cost.

Ask your nearest Ideal dealer, or write us for a copy of our latest catalog describing this *new* Ideal.

For Parks and Golf Courses

Ideal "Bulldog Gang Mowers are built to operate at tractor speed. In actual operation they have proven that it is possible to build cutting units that *will* stand up even when drawn behind a powerful tractor.

"Bulldog" Cutting Units have Timken bearings, Alemite lubrication—they are compact and sturdy with fewer wearing parts than any power unit built. They will deliver years of service.

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IDEAL
Power Lawn Mowers

Equipped with "Bulldog" cutting units

118

News and Illustrations

Items of Interest to City, Town and County Officials, and Others Interested in the Economical Construction and Efficient Operation of Public Improvement Undertakings

A Center Type Traffic Control Signal

The center type signal for controlling traffic is indispensable on boulevards and at intersections where wide, busy streets meet. In addition to its general utility, as an efficient, practical regulator of traffic it adds considerably to the impressiveness and beauty of the thoroughfare and drive. In practically all cases, the center type signal is placed near to or in the path of travel. Strong, rigid construction as a protection against wild and careless drivers is therefore necessary. The Klug & Smith Company, Milwaukee, Wis., builds its center type signal with a concrete base which is 2 feet 6 inches high and 2 feet 10 inches in diameter. The cabinet of this signal is furnished in either cast aluminum or cast iron and is arranged for either one, two, three or four sides to the cabinet, depending on the type of intersection. Illumination is greatly improved without the aid of sun visors by a special arrangement of reflectors and the particular kind of glass used for the lenses. Traffic change is contained in the top holder and is arranged with a bull's-eye on all four sides, allowing this command to be seen from all angles. This center type signal is also made as a corner signal or as a suspended type.

CENTER TYPE SIGNAL IN CENTER OF INTERSECTION—ITS BEST LOCATION

INSTALLATION OUTSIDE OF STREET-CAR TRACKS

The center type offers various positions, as illustrated. In the first illustration, the signal is shown mounted in the center of an intersection, which is its best position, because its mounting height on concrete, as noted above, brings the command of "Stop" or "Go" in the driver's direct line of vision. To accommodate this installation and allow a left turn, the roadway should not be less than 35 feet wide. Where the roadway is of sufficient width, signals of this type have been installed outside of street-car tracks, as shown in the second illustration.

For installation outside of car tracks there should be a minimum of 10 feet between the signal and the curb, unless street-car traffic is of minor importance and automobiles are allowed to travel to the left of the signal.

The third illustration shows the signal placed on a line with the curb and therefore using no portion of the roadway in the path of travel. Although this installation places the signal clear of all traffic, it is not considered the most practical. The driver coming on the right side of the signal is forced to look out and up from the left of his car, should he be stopped before reaching the intersection. Most drivers who must wait at intersections for opposite-bound traffic to clear, pull up as close to the line as possible. This may bring the driver to one side of the signal which is directing traffic contrary to the direction in which he is traveling. The Klug & Smith Company does not condemn this position, but wherever possible, it should be avoided. No complaints have been registered, but in setting

SIGNALS PLACED OUTSIDE THE ROADWAY

Why SIGNAPHORE TRAFFIC SIGNALS RENDER BETTER SERVICE!

Through sheer superiority of scientific development and mechanical design, Signaphore Traffic Control Signals effectively and economically solve every traffic problem existing from the small town thoroughfare to the most crowded streets of the busy city.

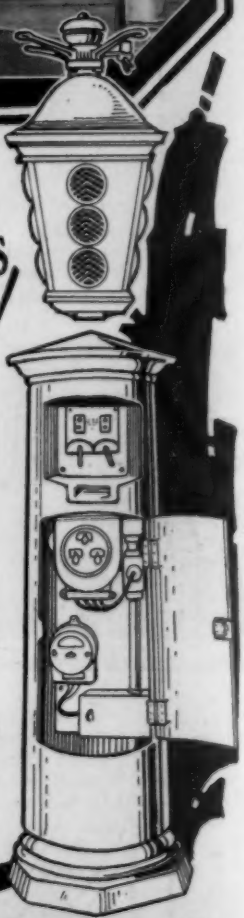
Many traffic authorities throughout the country are coming to recognize the fundamental improvements of traffic, both from the safety and efficiency standpoint, that is achieved by both the aerial and pedestal types of Signaphores which are operated by automatic and manual control.

Full information will be gladly furnished upon request.

The Tokheim Oil Tank & Pump Company

Fort Wayne, Ind.

Offices in all Principal Cities



SIGNAPHORE

STOP AND GO TRAFFIC SIGNALS

When writing to Advertisers please mention THE AMERICAN CITY—Thank you.

SIGNAL ARRANGED FOR THREE COMMANDS OF TRAVEL BECAUSE OF NUMEROUS LEFT TURNS

these devices this company endeavors to recommend the most practical position.

The fourth illustration shows an installation at an intersection where left turns are necessary and where the signal must record commands of travel. This arrangement permits east- and west-bound traffic to proceed either straight ahead or to make a right turn, followed by north- and south-bound traffic going either straight ahead or making a right turn, followed by a command of "Left turn—go." Instead of having the traffic-change panel in the center as in the standard arrangement, it is placed in the top compartment above the signal proper.

New Model Truck Announced

The announcement of a 3-ton truck which supplants an older model has been made by the Republic Motor Truck Company, Inc., Alma, Mich. This Republic Model 19, Third Series, is said by the manufacturers to have many vital improvements in design and construction. It is greatly improved in appearance and more sturdily built throughout.

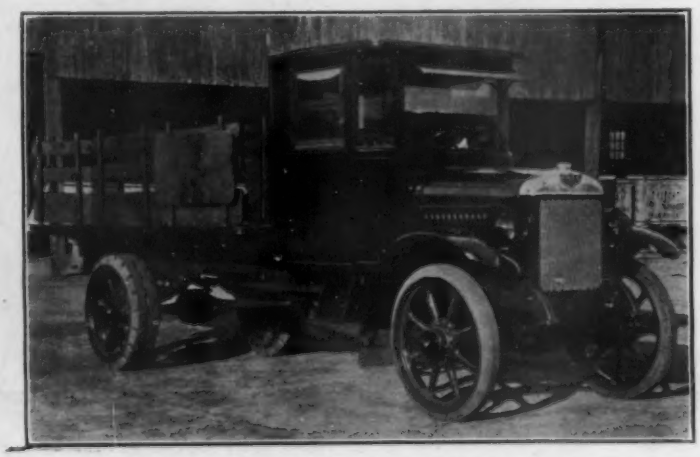
One of the striking developments of the new model is the newly designed radiator, which has an increased frontal area of approximately 60 square inches. The polished aluminum top tank surmounted by a heavy Republic Shield, together with the addition of a lower tank skirt, lends a distinctive appearance to the entire truck. In addition, the lower tank skirt affords cold weather protection to the lower water outlet.

This model has a new type clear-vision cab, which is roomy and comfortable, with ample leg room for operating the brake and clutch pedals. The wide glasses and narrow posts insure maximum vision and a minimum of dead spots. The driver's seat is divided so that the gasoline tank can be filled without removing the seat. The gas-filler spout extends up between the two sections of cushion. The tool compartment is located underneath the seat, with a door opening out on the right-hand side. Close-fitting joints make the cab absolutely weatherproof in all weather conditions. There are sliding storm curtains in the doors. The extra-wide doors provide easy entrance and exit. A sun visor protects the driver's eyes against the glare of the sun. A special spring mounting relieves the stresses set up by frame flexing. The depth of the frame has been materially increased, adding greatly to the strength of the entire chassis. The front cross-member is removable. Another important feature, and one which makes for increased strength, is the fact that the cross-members are riveted in such manner as to eliminate the localization of strain. The cross-members are also located at those points where the greatest stresses are found. The front tires are 36- x 5-inch and the rear tires 36- x 10-inch standard equipment. Heavier, longer, wider springs and larger eyes with replaceable bushings have been adopted for the new model. There is a tie-bar between the rear springs and the rear brackets. This tie-bar does not replace the shackle-bolt, as in the ordinary type of construction, but has its own points of application. This construction allows the standard high-carbon heat-treated bolts to be used for shackle action.

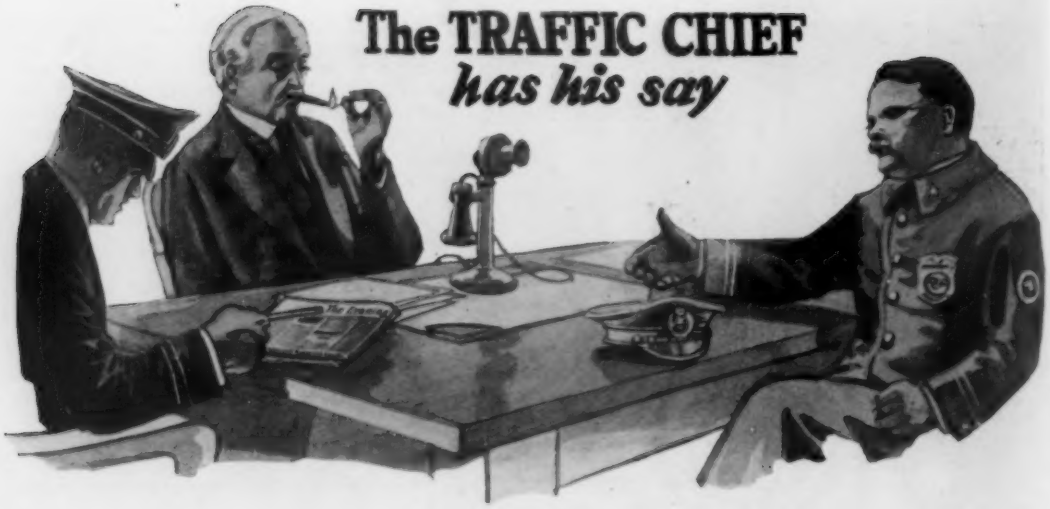
The new steering gear is a recently developed truck type of latest approved design with proper ratio in the screw to afford easy steering. There are ample bearing surfaces throughout. The steering gear can be moved easily because of the convenient location of the frame bracket below and its simple construction. The service brake is mounted on the front propeller shaft at the center bearing supports. It consists of a single laminated drum with two wide shoes mounted on a tubular member, especially designed for frequent application without excessive wear or overheating. Pressure feed lubrication to all working parts of the motor insures long life and maximum motor efficiency. The wheel-base of the new Model 19, Third Series, is 165 inches with 156 and 185 inches available.

Allen Heads Garford

The Garford Motor Truck Company, Lima, Ohio, has announced the election of C. M. Allen, formerly of Elizabeth, N. J., as President to succeed Emmett R. Curtin, who has resigned.



AN IMPROVED MODEL REPUBLIC TRUCK



The mayor is "determined"—the police superintendent "at his wits' end"—too many traffic accidents—newspapers "riding 'em" in scathing editorials—the fickle public clamoring for a reduction of auto accidents or the mayor and police heads' "scalps." Then they decide to "bring the matter to an issue"—they'll call in the chief of the traffic department and "get at the bottom of it."

He comes in and listens with a tolerant air and accepts all the blame—then throws this bomb—"Listen Gentlemen—our principal down-town streets were designed and layed out in 1865. They are ordinary 30 to 50 ft. streets—but plenty wide enough for 1865. Since then the street cars have come in and some 50,000 automobiles owned and operated within the city are using these self same streets that were designed to accommodate the horse drawn traffic of 60 years ago."

"My department can't stop traffic accidents unless you stop the street cars, direct tourists around the city and close up automobile sales rooms—or give us electrically operated traffic control units."

ESSCO STOP AND GO UNITS

Made by the pioneer builders of guaranteed traffic equipment.

ESSCO MANUFACTURING CO.

110 Harrison St. **Peoria, Ill.**

A TYPICAL SMALL PLAYGROUND

How to Plan Playgrounds

Experience has shown that the ideal playground should consist of three distinct and separated divisions; namely, the small children's division, the division for boys over 10 years, and the division for girls over 10. There are perhaps a great many reasons for the success of this plan, but it is instantly apparent that safety and mental, moral, and physical development are enhanced by its adoption. Pleasures that appeal to the small child obviously would not appeal to the older child who has grown away from the sand-box and craves more strenuous outlets for his energy. In his enthusiasm and self-forgetfulness the older child unintentionally endeavors to monopolize the apparatus and it would not be just to expect the younger child to cope with him for an opportunity to use the equipment. The reasons for separating the boys and girls over the age of 10 are self-evident to the enlightened.

The small child's division should be placed sufficiently far away from the other divisions to avoid the possibility of injury or molestation by the older and more strenuous children. The smaller children are usually contented at play and require less exertion, and their equipment should be planned to give them the greatest enjoyment with the necessary degree of physical development. A wading pool, not more than 20 inches deep at the deepest part, with draining facilities, a sand-box provided with cover for rainy weather, a small slide, teeter-board, pails and shovels, blocks and other toys, should be provided. This division should be placed in a shady section of the property and benches provided for mothers and governesses. Mothers seldom seem to have time to bring their children to the playground and remain there with them; therefore, a good, capable girl will do much toward keeping the children contented and relieving the mothers of any unnecessary worry.

The character of the apparatus for the girls' division is practically the same as for the boys' division. The lines of physical development of the modern young girl closely parallel those of the boy, so that the same playground could be used for either. The main reason for the separation is not so much the difference in requirements as the advisability of segregation from the moral and safety standpoint, and of provision to insure the development of fine mental qualities along with physical strength. Gracefulness and poise should be considered and, if possible, a limited amount of class instruction in esthetic dancing should be given. A capable instructor for the girls' division is an absolute necessity. One who knows the problems of growing girls and can direct their efforts in the paths of the most elevating enjoyment can be of valuable assistance in making them strong and clean-minded.

Filled with vigor and seeking an outlet for his energy, the boy requires apparatus that will give him an opportunity for the development of his muscles. Running, swinging, jumping, and climbing, the typical boy wants action and lots of it.

INSTALLATION OF A MEDIUM-SIZED PLAYGROUND

MAKES 'EM STOP

THE MULTI CONTROL STANCHION

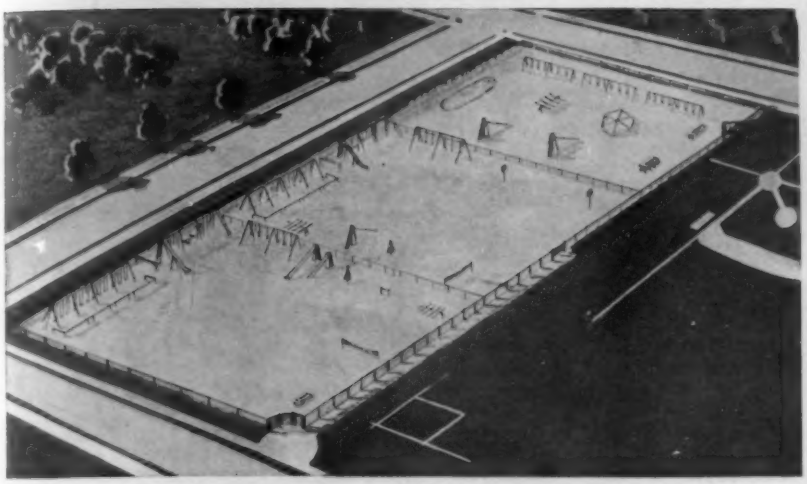
Controls Traffic, manually or automatically, at Y Intersections, from one to six approaches. Built of Aluminum throughout because of its weather resisting properties.

CATALOG ON REQUEST

HORNI SIGNAL MFG. CORP.

145-155 FRELINGHUYSEN AVE.

NEWARK NEW JERSEY



A LARGE PLAYGROUND WITH QUITE COMPLETE EQUIPMENT

Plenty of action and utmost safety should be the keynote in planning the boys' section. To give suggestions for equipping the boys' division without knowing the size of the playground is almost impossible, but to name the equipment in the order of desirability may, perhaps, help. The F. B. Zieg Manufacturing Company, Fredericktown, Ohio, makers of Paradise playgrounds, suggests the following list: the universal favorite of all children is the slide, and the wave slide is the most popular; then come swings, giant strides, merry-go-rounds, traveling rings, teeter-boards, and then the stationary equipment, such as horizontal bars, ladders, and climbing poles. Whether a city official is considering a small lot or a large school playground, the Planning Department of the manufacturer will be pleased to work out a ground plan and assist him in every way in selecting and placing the proper equipment for the greatest efficiency.

Especially in the school field, where the tendency is to install only the best of everything, the playground is sometimes planned in advance and a tract afterwards purchased sufficiently large to meet all needs of the plans adopted. In this case, where space and finances are unlimited, the completeness of a playground is the main consideration. At times the space is unlimited but the appropriation curtailed. In planning a playground under these conditions, it is always the best policy to select the equipment in the order of its desirability, allotting a certain amount for the equipment and reserving an amount to care for surfacing, beautifying, purchasing balls, etc.

Almost invariably the playground must be planned to fit a space already selected. Frequently the appropriation for this purpose is limited. A thorough knowledge of playground planning is valuable here, because every foot of space must be made to produce the maximum amount of pleasure with the least expense. A playground can be planned consisting of a few units to fit the ordinary 50 x 100-foot lot, or it can be planned for an entire city block.

The Economy of Steel Paving Guards

Steel paving guards that anchor deep in the base of the paving and form a rigid steel retaining wall, 2 inches high, have definitely proved their value and effectiveness on concrete and bituminous roads. In one instance where a 6-inch concrete edging was placed along an asphalt pavement, the concrete edging was badly worn away by trucks running off the edge, while the asphalt pavement proper, protected with a 2-inch steel paving guard, made by the W. S. Godwin Company, Inc. Race and Mc-Comas Streets, Baltimore, Md., was intact and unraveled.

The accompanying illustration offers another example of the value of steel paving guards. It is taken at the entrance to Sea View Hospital, New York City, and shows a 2-inch asphaltic concrete road laid on a 6-inch concrete base in 1917. The

EVIDENCE OF PROTECTION AFFORDED BY STEEL PAVING-GUARD

SAINT PAUL
MINNESOTA

Lyle Style 291, One Piece Wing Sign, Adopted as Standard by St. Paul Bureau of Engineers.

WRITE FOR DETAILS

LYLE CARVED -IN- SIGNS

Factory at
Minneapolis Minn. U. S. A.

"Leaders in the Sign and Signal Field for Over Twelve Years."

top of the picture shows the 6-inch concrete headers used to hold the edge of the asphaltic pavement. In the center of the pictures the headers have had to be replaced with other slabs, while in the foreground where the asphaltic concrete pavement is held in place by a steel paving guard, there is no raveling and the pavement is intact.

INTERSECTION OF NORTH SHORE ROAD AND REVERE STREET, REVERE, MASS., SHOWING AREA LAID WITH LUMNITE CEMENT, WHICH HARDENED FOR TRAFFIC OVER NIGHT

Revere, Mass., Saves Three Weeks on Cement Work

In the construction of Revere Street, Revere, Mass., Joseph Tomasello found Atlas Lumnite cement, a quick-hardening alumina cement, made by the Atlas Lumnite Cement Company, 25 Broadway, New York City, a ready solution of a difficult construction problem. The State Highway Department had forbidden the blocking of traffic at the intersection of North Shore Road. Because of a fire-house on Revere Street, it was also necessary to keep this street open. The intersection contained about 1,000 square yards of 7-inch reinforced concrete pavement.

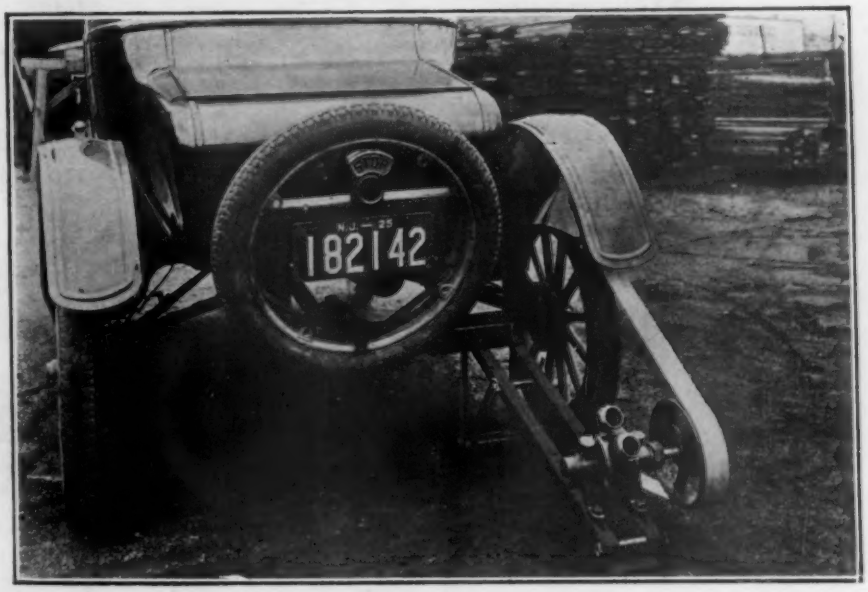
The contractor proceeded to put in one corner with Lumnite cement concrete on the 6th of November, opening it on the 7th, allowing traffic to go over it in 24 hours. The next day he put in another quarter of the section. The balance of the section was completed with portland cement. The quick-hardening concrete carried traffic in both directions during the three-weeks' cure of the ordinary portland cement. If this intersection had been done with portland cement, it would have taken the contractor six weeks to complete the work. This would have brought the work into the middle of December, when it would have undoubtedly been too cold to complete the work.

The quick-hardening cement was used in a 1:2:4 mix and was 7-inch reinforced concrete slab.

A Novel Fire Pump

A fire pump that can be carried in the back seat of any small motor car and which can be quickly rigged behind the machine to handle any moderate-size pumping job, has been placed on the market by Christian A. Volf, Jr., Irvington, N. J. This Dana fire pump is a small centrifugal and rotary unit which is run by the gear wheel of a small automobile or truck. The complete equipment consists of the pump and pulley, a rubber belt, a steel frame, a solid brass 10-inch nozzle, a rattan suction basket, 15 feet of discharge hose, 1½ inches in diameter, and 25 feet of 1½-inch suction hose.

This outfit is particularly useful in pumping out trenches and flooded cellars, and has also been used very successfully in fighting forest fires, having been endorsed by the New York State District Foresters. The pump has a lifting capacity of 24 feet through the 1½-inch suction hose, and will carry water through 2,000 feet of hose and still deliver enough water at sufficient pressure to put out a fire in the average home or farm. No priming is necessary to start the Dana pump.



DANA PUMP SET UP READY FOR SUCTION AND DISCHARGE LINES TO BE ATTACHED

For Safety's Sake Use Kuhlman Series Multiple Street Lighting Systems

The use of Kuhlman Series Multiple Transformer assures absolute safety from dangerous high voltage current in case the street lighting standard is demolished.

There is no likelihood of breakdowns between high and low voltage windings, and no possibility of exposing primary high voltage wires.

Persons involved in such an accident or passersby are safe from current.

Also the use of Kuhlman Series Multiple System divides the risk of darkness. An accident affects only the specific lamp involved.

Ask for Bulletin 1200

Kuhlman Electric Company

Manufacturers of Power, Power Distribution and Street Lighting Transformers

BAY CITY, MICHIGAN

New York City Adopts Use of Multi-Unit Tank-Car for Chlorine

The water-supply of New York City is secured from vast watersheds in the upper Hudson valley and is chlorinated without filtration or other treatment. Because of the great consumption of this largest city in the world, a very large amount of chlorine is necessary. The ordinary 105- or 150-pound cylinder of chlorine is altogether too small a unit on this work, so that the Water Department of New York City has adopted at Ashokan the use of the Mathieson Multi--Unit Tank-Car which was developed by the engineers of the Mathieson Alkali Works, Inc., 250 Park Avenue, New York City. Although this type of equipment has long been used by a large number of paper mills, by chemical manufacturers, textile bleacheries, petroleum refineries, and others, New York City is the first municipality to take advantage of its economy and convenience.

On this car liquid chlorine is shipped in fifteen 1-ton units. The design of the car follows the standard steel underframe construction, its novelty consisting in the cradles which hold the 1-ton units. These cradles are a part of the car frame, and the method of clamping secures the containers rigidly without danger of shifting or accidental removal from the car. This not only minimizes the danger attending the transportation and storage of liquid chlorine, but also by its small unit containers as compared with the single tank-cars formerly used, makes possible greater economy and efficiency in its use.

The 1-ton drums in which Mathieson liquid chlorine is shipped are forged steel cylinders with a wall thickness of ⅜-inch. The outside diameter is 30 inches and the over-all length 80 inches. The head of the drum is lap-welded to the body proper and has a thickness of ¾-inch. An easily removable bonnet fits over the valves and protects them from injury. Each drum is equipped with six safety plugs, three screwed into each head filled with fusible metal of fusing point approximately 150 degrees Fahrenheit. The purpose of these plugs is to release the contents in case of fire before a pressure is reached sufficient to rupture the drum. The containers are tested for an internal pressure of 500 pounds per square inch and comply with all regulations of the Bureau of Explosives and the Interstate Commerce Commission. The drum alone weighs approximately 1,300 pounds and contains exactly 2,000 pounds of liquid chlorine.

When this car was first placed in service by the Mathieson Alkali Works, over two years ago, the transportation companies refused to allow it the same rates and privileges as other tank-cars. Convinced that the continued service of the multi-unit car was to the best interest of both the public and the chlorine-consuming industries, the Mathieson Company appealed to the Interstate Commerce Commission for removal of this discrimination and continued making shipments at greatly increased expense. During 1922 and 1923 over $200,000 was paid out in excess freight charges on shipments made in this car. On January 31, 1924, a decision of the Interstate Commerce Commission approved of the multi-unit tank-car, giving it the same rates and privileges and other tank-cars and repaying all excess charges of the preceding two years.

Brick Manufacturers Association Elects Officers

At the regular quarterly meeting of the National Paving Brick Manufacturers Association, at Cleveland, Ohio, on March 17, W. P. Whitney, President of the Springfield Paving Brick Company, Springfield, Ill., was elected President for the ensuing year. The other officers of the Association were re-elected, as follows: O. W. Renkert, Chairman of the Board; C. C. Barr, Treasurer; B. L. Beller, Assistant Treasurer; Edward E. Duff, Jr., Secretary; Stanley A. Knisely, Assistant Secretary.

Changes in Industrial Works' Sales Organization

Industrial Works, Bay City, Mich., has announced that Lyle Marshall, former Manager of the Service Department and later connected with the Chicago office, has recently been appointed District Sales Manager, with new offices at 619 Dixie Terminal Building, Cincinnati, Ohio. James E. Shearer, Assistant Sales Manager, has moved his headquarters from Bay City to the New York office, 50 Church St., New York City. George T. Sinks, in charge of the New York District, will remain in that position.

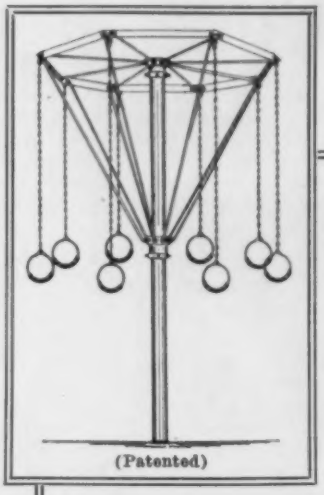
New Office and Representative for Dayton-Dowd

The Dayton-Dowd Company, Quincy, Ill., has announced the opening of a new office in Detroit at 841 David Whitney Building, in charge of E. E. Maher and E. P. Johnson. The Power Equipment Company, 131 State Street, Boston, Mass., has been appointed sales representative for the New England District.

Pipe-Pusher Saves Trench Costs

A pipe-pusher with which one man can exert a push of 7,000 pounds on the pipe is being made by the Giant Manufacturing Company, Council Bluffs, Iowa. This one-man machine is compact, easily handled, powerful and rapid in operation. It is simple in construction and built very strong. Its bed is made entirely of steel with oversize bearings and compound leverage. In operation it is quickly staked down, and does its work close to the bank, thus eliminating any possibility of bending the pipe. Its pipe grip is positive and the release automatic. It is claimed that on an average it eliminates more than four-fifths of trenching of pipe from ½-inch up to 4 inches in diameter.

It is a particularly handy tool in that it eliminates digging trenches across lawns or highways or in places where, by reason of conditions, trenches would be impossible. Its average capacity is three lengths of pipe per hour. Under varying conditions with various operators it has pushed as high as 5 feet per minute. Most kinds of hardpan, fire-clay and gumbo do not interfere with its successful operation. There are very few places where there isn't enough suitable ground to justify a water department in having one of these machines. Even in extremely rocky locations the machine can be used effectively to draw out old damaged pipe and replace it with a new section.



(Patented)

JUST ONE ROUND OF JOY

On these Stationary Circular Travel Rings the children swing joyously from ring to ring in an endless path. Children love to exhibit their prowess on these rings, and instructors pronounce them the most healthful device yet offered.

Unlike the straight-away Travel Rings, the circular arrangement forces reaching and stretching of arms and legs into positions different from any similar apparatus and prevents curvature of the spine.

An incline board is furnished with each set of rings for the use of the smaller children in starting.

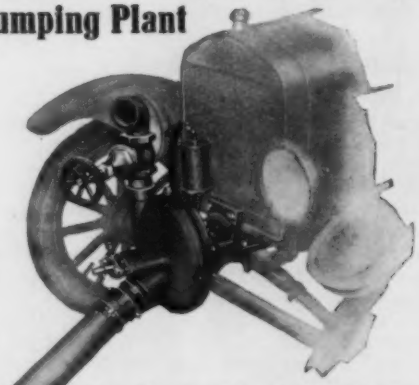
Drop a card in the mail-box today asking for our illustrated catalog describing our many novel fun-giving, health-bringing types of playground apparatus.

Patterson-Williams Manufacturing Co.

Improved Playground Apparatus

San Jose -:- -:- California

Make Your Truck or Tractor a Pumping Plant



The Barton Portable Pump

This is the latest and most practical portable pumping equipment ever devised using the motive power of cars, tractors or trucks by means of a patented power take-off that connects pump with the motor. Capacity ranges from 80 to 400 gallons per minute.

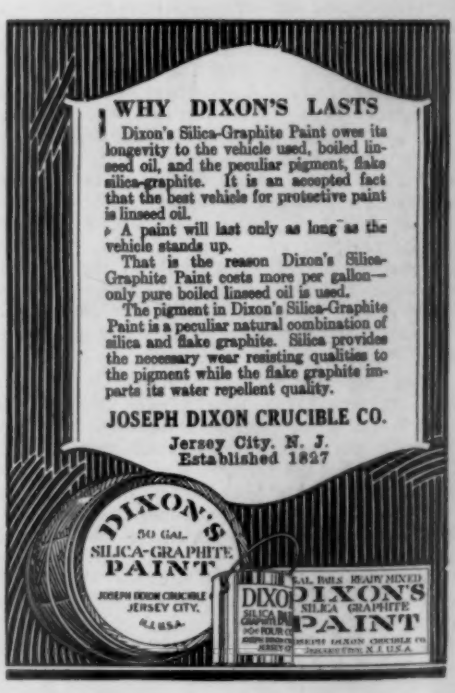
EQUIPPED WITH AUTOMATIC PRIMER which primes the pump in less than a minute. Pump can be attached and detached in three minutes.

Ideal for fire protection, pumping out excavations and for general utility purposes.

Ask for Bulletin.

AMERICAN STEAM PUMP CO.

BATTLE CREEK MICHIGAN


WHY DIXON'S LASTS
Dixon's Silica-Graphite Paint owes its longevity to the vehicle used, boiled linseed oil, and the peculiar pigment, flake silica-graphite. It is an accepted fact that the best vehicle for protective paint is linseed oil.
A paint will last only as long as the vehicle stands up.
That is the reason Dixon's Silica-Graphite Paint costs more per gallon—only pure boiled linseed oil is used.
The pigment in Dixon's Silica-Graphite Paint is a peculiar natural combination of silica and flake graphite. Silica provides the necessary wear resisting qualities to the pigment while the flake graphite imparts its water repellent quality.
JOSEPH DIXON CRUCIBLE CO.
Jersey City, N. J.
Established 1827
DIXON'S
50 GAL.
SILICA-GRAPHITE
PAINT
JOSEPH DIXON CRUCIBLE
JERSEY CITY,
U.S.A.
DIXON'S
SILICA GRAPHITE
PAINT